PV Inverter

SUNNY MINI CENTRAL 4600A / 5000A / 6000A

Installation Manual

SMC46-60A11-IA-en-80 | IME-SMC50A_60A | Version 8.0

EN

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1 Information on this Manual

1.1 Validity

This installation manual describes the assembly, installation, commissioning, maintenance and troubleshooting of the following SMA inverters:

- Sunny Mini Central 4600A (SMC 4600A, SMC 4600A-11)
- Sunny Mini Central 5000A (SMC 5000A, SMC 5000A-11)
- Sunny Mini Central 6000A (SMC 6000A, SMC 6000A-11)

Keep this manual in a convenient place for future reference.

1.2 Target Group

This manual is for electrically qualified persons. The tasks described in this manual may be performed by electrically qualified persons only.

1.3 Additional Information

You will find further information on special topics such as designing a miniature circuit-breaker or the description of the operating parameters in the download area at www.SMA-Solar.com.

Refer to the user manual provided for detailed information on operating the inverter.

1.4 Symbols Used

The following types of safety precautions and general information are used in this manual:

DANGER!

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING!

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION!

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE!

NOTICE indicates a situation that can result in property damage if not avoided.

Information

Information provides tips that are valuable for the optimal installation and operation of your product.

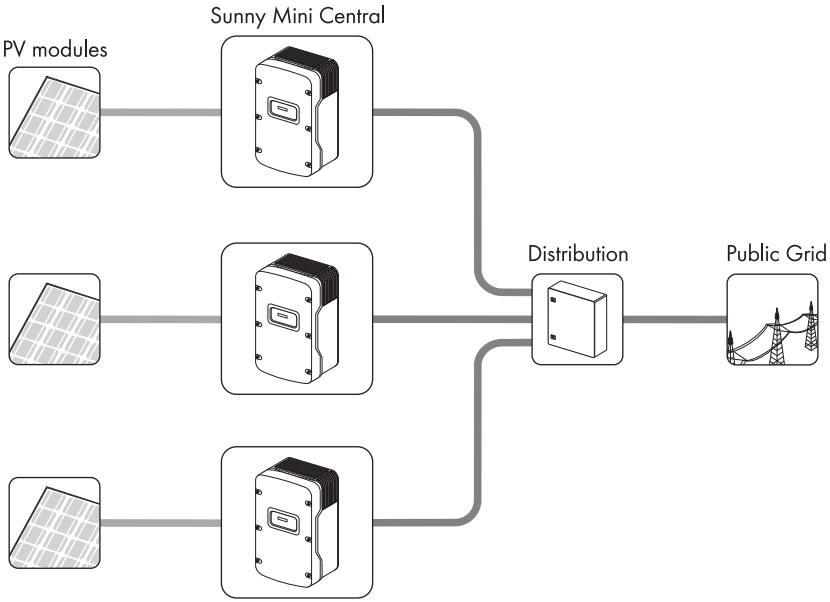
☑ This symbol indicates the result of an action.

2 Safety

2.1 Intended Use

The Sunny Mini Central is a PV inverter which converts the direct current of the PV array to alternating current and feeds it into the power distribution grid.

Operating Principle of a PV Plant with Sunny Mini Central



The Sunny Mini Central may only be operated with PV arrays (PV modules and cabling) of protection class II. Do not connect any energy sources other than PV modules to the Sunny Mini Central.

When designing the PV plant, ensure that the values comply with the permitted operating range of all components at all times. The free design program "Sunny Design" (www.SMA-Solar.com/SunnyDesign) will assist you. The manufacturer of the PV modules must have approved the modules for use with this Sunny Mini Central. You must also ensure that all measures recommended by the module manufacturer for long-term maintenance of the module properties are taken (see also Technical Information "Module Technology" in the download area of www.SMA-Solar.com).

For safety reasons, it is forbidden to modify the product or install component parts that are not explicitly recommended or distributed by SMA Solar Technology AG.

2.2 Safety Precautions

DANGER!

Danger to life due to high voltages in the inverter.

- All work on the inverter may only be carried out by an electrically qualified person.

CAUTION!

Risk of burns due to hot enclosure parts.

- Do not touch the enclosure during operation.
- Only touch the enclosure lid during operation.

NOTICE!

Dust and water intrusion can damage the inverter.

Once the Electronic Solar Switch has been pulled out, the inverter only provides degree of protection IP21. The inverter is then no longer protected against water and dust intrusion. In order to also maintain degree of protection IP65 during temporary decommissioning, proceed as follows:

- Unlock and disconnect all DC connectors.
- Open all DC connectors and remove the cables.
- Close all DC inputs with the corresponding DC connectors and the supplied sealing plugs.
- Firmly connect the Electronic Solar Switch again.

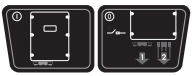
PV array grounding

Comply with the local regulations for grounding the PV modules and the PV array. In order to maintain the best possible protection for both the PV plant and human life, SMA Solar Technology AG recommends connecting together the PV array frame and other electrically conductive surfaces and grounding them.

2.3 Explanation of Symbols

This section gives an explanation of all the symbols found on the inverter and on the type label.

2.3.1 Symbols on the Inverter

Symbol	Explanation
	Operation display. Indicates the operating state of the inverter.
	Ground fault or varistor defective. Read section 9.3 "Red LED is Permanently Lit" (page 65).
	Error or fault. Read section 9 "Troubleshooting" (page 60).
	You can operate the display by tapping the enclosure lid: • Tapping once: the backlight switches on or the display scrolls to the next display message. • Tapping twice in quick succession: The inverter shows the display messages from the startup phase again (see section 6.2 "Display Messages During the Startup Phase" (page 48)).
	DC load disconnection unit Electronic Solar Switch (ESS) • ❶ When the Electronic Solar Switch is plugged in, the DC electric circuit is closed. • ⓪ To interrupt the DC electric circuit and safely disconnect the inverter when under load, you must first remove the Electronic Solar Switch ❶ and then all DC connectors ❷.
	QR Code® for SMA bonus program You will find information on the SMA bonus program at www.SMA-Bonus.com.

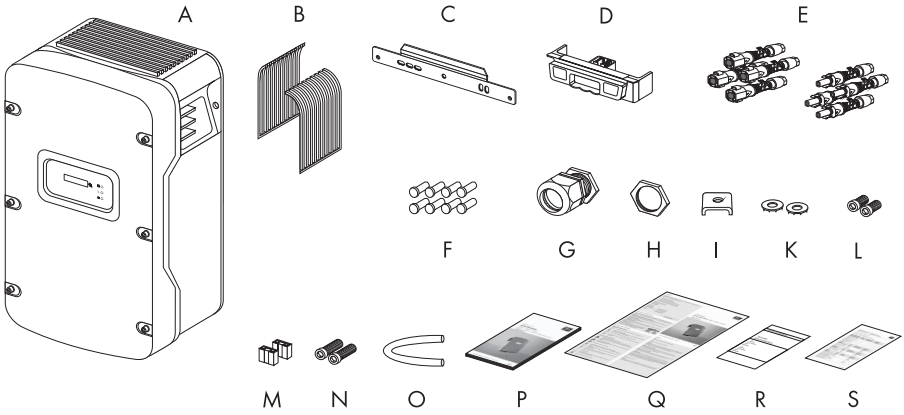
2.3.2 Symbols on the Type Label

Symbol	Explanation
	Beware of hazardous voltage. The inverter operates at high voltages. All work on the inverter may only be carried out by an electrically qualified person.
	Beware of hot surface. The inverter can become hot during operation. Avoid contact during operation.
	Observe all documentation that accompanies the inverter.
	The inverter must not be disposed of together with the household waste. For more information on disposal, see section 10.4 "Disposing of the Inverter" (page 71).
CE	CE mark. The inverter complies with the requirements of the applicable EC guidelines.
	The inverter has a transformer.
DC	Direct current (DC)
AC	Alternating current (AC)
	Outdoor The product is suitable for outdoor installation.
IP65	Degree of protection IP65. The inverter is protected against dust intrusion and water jets from any angle.
	RAL quality mark for solar products. The inverter complies with the requirements of the German Institute for Quality Assurance and Labeling.

3 Unpacking

3.1 Scope of Delivery

Check the delivery for completeness and any externally visible damage. Contact your specialty retailer if anything is damaged or missing.



Object	Quantity	Description
A	1	Sunny Mini Central
B	1	Fan guards (right/left)
C	1	Wall mounting bracket
D	1	DC load disconnection unit Electronic Solar Switch (ESS)
E	8	DC connectors (4 x positive, 4 x negative)
F	8	Sealing plugs for the DC connectors
G	1	Cable gland for AC connection
H	1	Counter nut for cable gland at AC connection
I	1	Clamping bracket for additional grounding
K	2	Conical spring washers: 1 x for enclosure lid screws (replacement), 1 x for ground terminal
L	2	Cheese-head screws (M6x16): 1 x for enclosure lid (replacement), 1 x for ground terminal
M	2	Jumpers (1 x for fan test, 1 x for the SMA Power Balancer wiring)
N	2	Cheese-head screws (M6x8) for securing the inverter to the wall mounting bracket
O	1	Silicone tube for insulating the SMA Power Balancer connection cable
P	1	Installation Manual
Q	1	User Manual

Object	Quantity	Description
R	1	Set of documents with explanations and certificates
S	1	Supplementary sheet with inverter default settings

3.2 Identifying the Inverter

You can identify the inverter using the type label. The type label is on the right-hand side of the enclosure.

The serial number (Serial No.) and the type (Type/Model) of the inverter, as well as device-specific characteristics are specified on the type label.

4 Mounting

4.1 Safety

DANGER!

Danger to life due to fire or explosion.

Despite careful construction, electrical devices can cause fires.

- Do not mount the inverter on flammable construction materials.
- Do not mount the inverter in areas where highly flammable materials are stored.
- Do not mount the inverter in a potentially explosive atmosphere.

CAUTION!

Risk of burns due to hot enclosure parts.

- Mount the inverter in such a way that it cannot be touched inadvertently.

CAUTION!

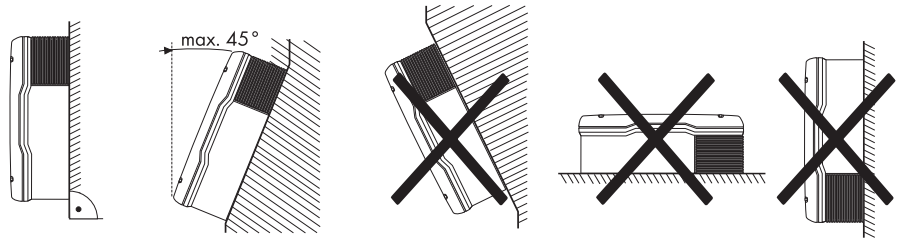
Risk of injury due to the heavy weight of the inverter.

- Take the inverter's weight of approx. 63 kg into account for mounting.

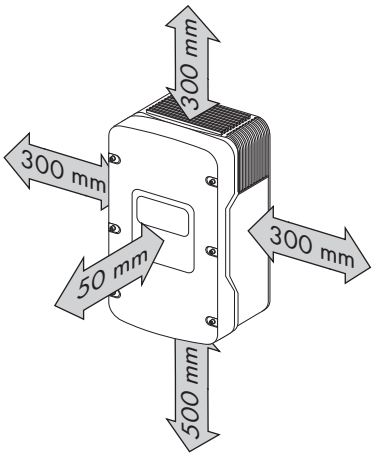
4.2 Selecting the Mounting Location

Consider the following requirements when selecting the mounting location:

- The mounting method and location must be suitable for the inverter's weight and dimensions (see section 11 "Technical Data" (page 72)).
- Mount on a solid surface.
- The mounting location must at all times be clear and safely accessible without the use of additional aids such as scaffolding or lifting platforms. Non-fulfillment of these criteria may restrict servicing.



- Mount vertically or tilted backwards by max. 45°.
- The connection area must point downward.
- Never mount the device with a forward tilt.
- Never install the device with a sideways tilt.
- Do not mount horizontally.
- Mount at eye level to allow operating states to be read at all times.
- The ambient temperature should be below 40°C to ensure optimum operation.
- Do not expose the inverter to direct solar irradiation as this can cause excessive heating and thus power reduction.
- In living areas, do not mount the unit on plasterboard walls or similar to avoid audible vibrations. When in use, the inverter emits noises which may be perceived as a nuisance in a living area.
- Observe the minimum clearances to walls, other inverters, or objects as shown in the diagram in order to ensure sufficient heat dissipation and sufficient space for removing the Electronic Solar Switch.



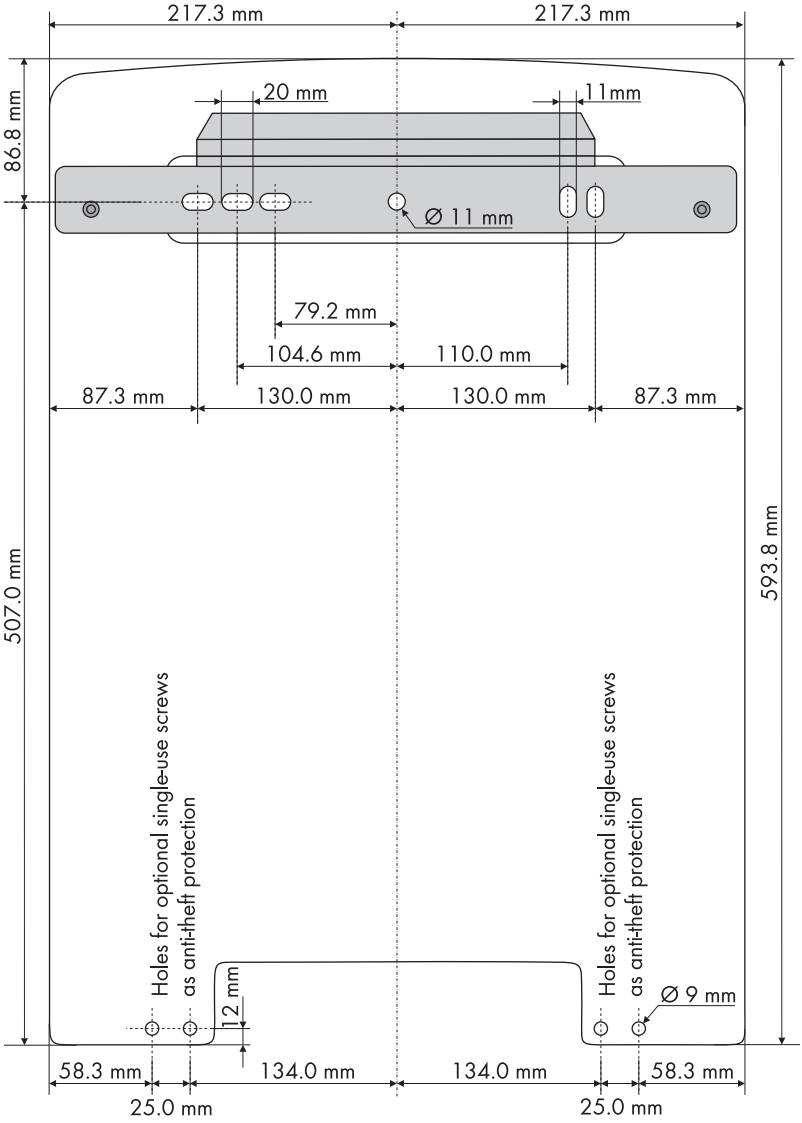
Multiple inverters installed in areas with high ambient temperatures

There must be sufficient clearance between the individual inverters to ensure that the cooling air of the adjacent inverter is not taken in.

If necessary, increase the clearance spaces and make sure there is enough fresh-air supply to ensure sufficient cooling of the inverters.

4.3 Mounting the Inverter with the Wall Mounting Bracket

1. Mark the position of the drill holes using the wall mounting bracket and drill the holes. Use at least 2 of the 6 holes, with 1 hole on the right and 1 on the left.

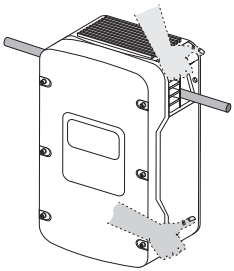


CAUTION!

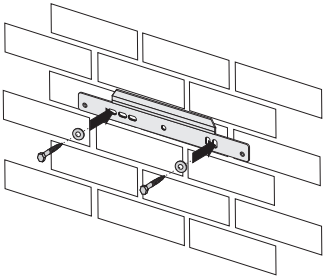
Risk of injury due to the heavy weight of the inverter.

The inverter weighs approx. 63 kg.

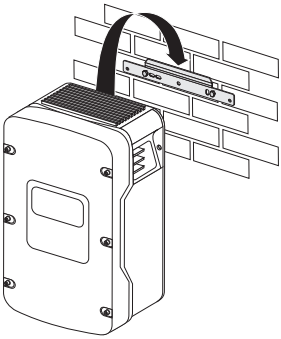
- Attach the wall mounting bracket with the corresponding mounting material (depending on the surface).
- Use the side handles (above and below) or a steel rod (maximum diameter of 30 mm) for transport and mounting. The rod must be pushed through the enclosure openings.



2. Secure the wall mounting bracket to the wall using appropriate screws and washers.

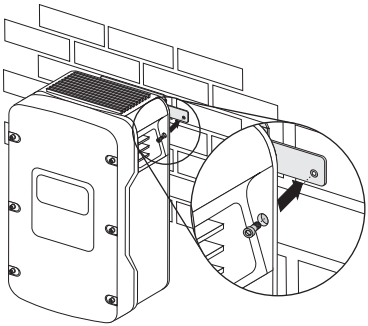


3. Hang the inverter onto the wall mounting bracket using the opening for this purpose in the rear of the enclosure.



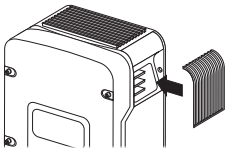
4. Screw the inverter onto the wall mounting bracket on both sides using the screws (M6x8) provided.

   Only tighten the screws hand-tight.



5. Check to ensure that the inverter is securely in place.
6. Close the recessed grips with the fan guards provided. To help you identify the sides, the fan guards are marked "rechts/right" and "links/left" on the inside.

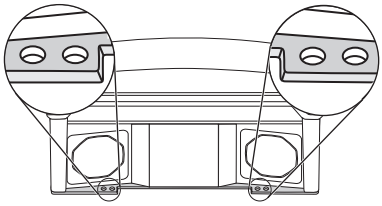
   The fan guards prevent dirt and insects from entering the device and, if necessary, can be reordered from SMA Solar Technology AG (see section 13 "Contact" (page 81)).



Optional anti-theft protection

To protect the inverter against theft, the back panel can be secured to the wall at the bottom using 2 safety screws.

The other 2 holes are spares.



5 Electrical Connection

NOTICE!

Electrostatic discharges can damage the inverter.

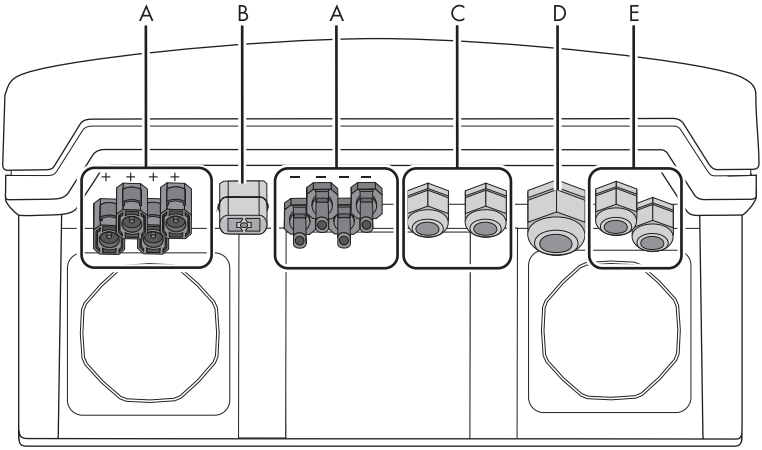
Internal component parts of the inverter can be irreparably damaged by static electric discharge.

- Ground yourself before touching a component part.

5.1 Overview of the Connection Area

5.1.1 Exterior View

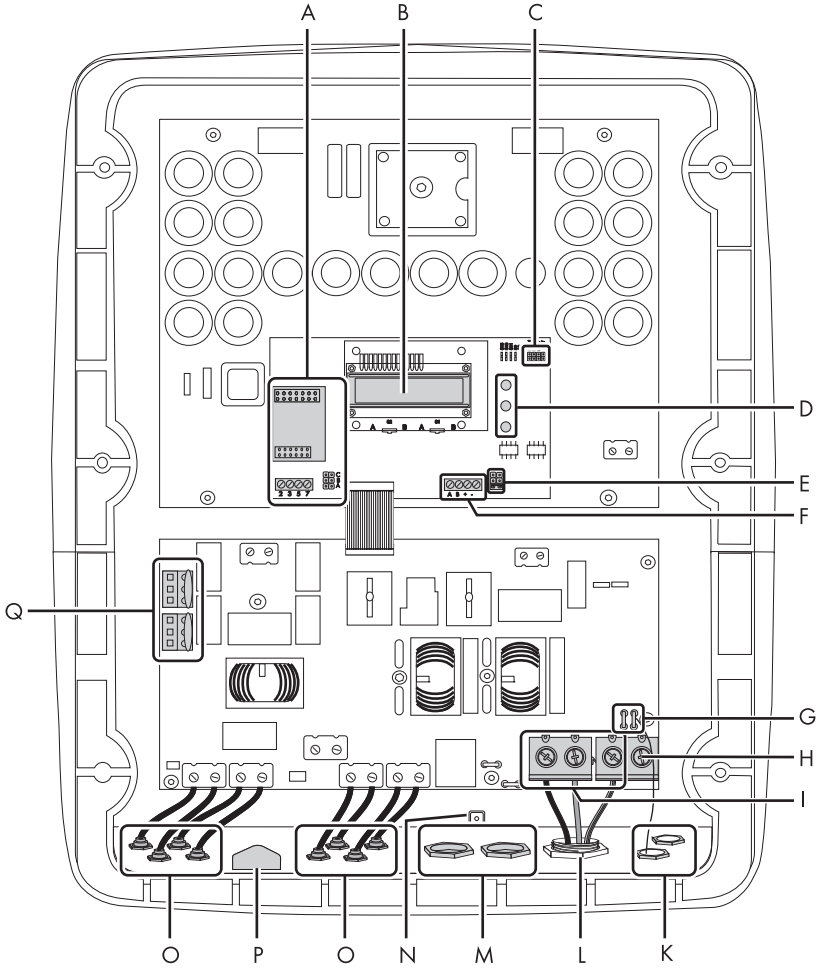
The following figure shows the assignment of the individual connection areas on the bottom of the inverter.



Object	Description
A	DC connectors for connecting the PV strings
B	Jack for connecting the Electronic Solar Switch (ESS) DC load disconnection unit
C	Cable glands for optional communication via RS485 (PG16)
D	Cable gland for connection to the power distribution grid (AC) (12 mm ... 25 mm)
E	Cable glands for SMA Power Balancer

5.1.2 Interior View

The following figure shows the various components and connection areas of the open inverter.



Object	Description
A	Connection area and slots for communication
B	Display
C	Jumper slot for the fan test
D	LEDs for displaying the operating states
E	Jumper slot for SMA Power Balancer
F	Terminals for SMA Power Balancer
G	Flat male tab for grounding the cable shield when connecting the SMA Power Balancer
H	Additional terminal for grounding
I	Terminals for AC cables
K	Cable glands for the SMA Power Balancer
L	Cable gland for AC-cable
M	Cable glands for communication
N	Screwing device for shield connection terminal for communication cable
O	DC connector
P	Connection jack for Electronic Solar Switch (ESS)
Q	Varistors

5.2 Connection to the Power Distribution Grid (AC)

5.2.1 Conditions for the AC Connection

Connection requirements of the grid operator

Always observe the connection requirements of your grid operator.

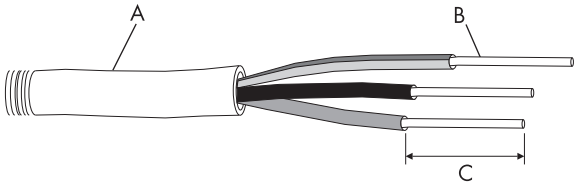
Cable Design

Use "Sunny Design" version 2.0 or higher for the dimensioning of the conductor cross-sectional areas (see "Sunny Design" program at www.SMA-Solar.com).

Halving the cable losses

If 3 inverters with symmetrical feed-in are combined to form a three-phase system, the neutral conductor is not subjected to any load, and the cable losses are halved. Thus, the maximum possible cable length is doubled.

Cable Requirements



Position	Designation	Value
A	External diameter	12 mm ... 25 mm
B	Conductor cross-section	6 mm² ... 16 mm²
C	Length of insulation to be stripped off	approx. 16 mm

Load Disconnection Unit

You must install a **separate** miniature circuit-breaker for each inverter in order to ensure that the inverter can be securely disconnected under load. The maximum permissible fuse protection can be found in section 11 "Technical Data" (page 72).

Detailed information and examples for the rating of a miniature circuit-breaker can be found in the Technical Information "Miniature Circuit Breaker" in the SMA Solar Technology AG download area at www.SMA-Solar.com.

DANGER!

Danger to life due to fire.

When more than 1 inverter is connected in parallel to the same miniature circuit-breaker, the protective function of the miniature circuit-breaker is no longer guaranteed.
It can result in a cable fire or destruction of the inverter.

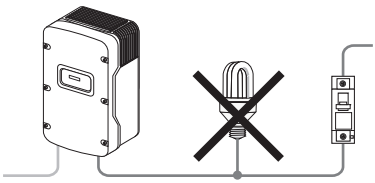
- Never connect several inverters to the same miniature circuit-breaker.
- Observe the maximum permissible fuse protection of the inverter when selecting the miniature circuit-breaker.

DANGER!

Danger to life due to fire.

When a generator (inverter) and a load are connected to the same miniature circuit-breaker, the protective function of the miniature circuit-breaker is no longer guaranteed. The current from the inverter and the power distribution grid can accumulate to overcurrent which is not detected by the miniature circuit-breaker.

- Never connect loads between the inverter and the miniature circuit-breaker without fuse protection.
- Always protect loads separately.



NOTICE!

Damage to the inverter by using screw type fuses as a load disconnection unit.

A screw type fuse, e.g. DIAZED fuse or NEOZED fuse, is not a switch-disconnector and thus may **not** be used as a load disconnection unit. A screw type fuse only acts as cable protection.

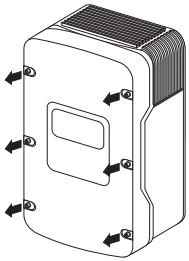
When disconnecting under load using a screw type fuse, the inverter can be damaged.

- Use only a switch-disconnector or a miniature circuit-breaker as a load disconnection unit.

5.2.2 Connecting the Inverter to the Power Distribution Grid (AC)

1. Check the line voltage and compare with "$V_{AC\ nom}$" on the type label.

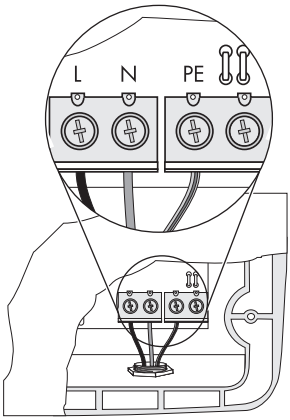
   The exact operating range of the inverter is specified in the operating parameters.
   The corresponding document is available in the download area at www.SMA-Solar.com.
2. Disconnect the miniature circuit-breaker and secure against reconnection.
3. Loosen all screws of the enclosure lid and remove the lid.



4. Remove the adhesive tape from the AC enclosure opening (see "D" on Page 20).
5. Insert the AC cable gland from the outside into the enclosure opening and tighten it from the inside with the counter nut.
6. Unscrew the cable gland's lock nut and pass it over the cable.
7. Route the cable through the cable gland to the AC terminal.
8. Connect L, N and the protective conductor (PE) to the terminal blocks using a screwdriver in accordance with the label.

   To do this, the PE insulated conductor must be 5 mm longer than the L and N insulated conductors.

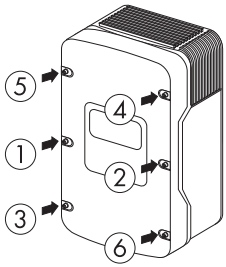
   L and N must not be swapped.



9. Tighten the lock nut firmly to the cable gland.
10. Secure the enclosure lid with all screws and the corresponding conical spring washers.

    Tighten the screws with 6 Nm torque in the order shown in the figure on the right. The toothing of the conical spring washers must point toward the enclosure lid.

    The scope of delivery of the inverter includes another spare screw and conical spring washer.



DANGER!

Danger to life due to enclosure lid carrying voltage.

The grounding of the enclosure lid is ensured by the conical spring washers.

- Attach the conical spring washers for all 6 screws with the toothing facing toward the enclosure lid.

DANGER!

Danger to life due to high voltages in the inverter.

- Do not switch on the miniature circuit-breaker until the PV array has also been connected and the inverter is securely closed.

☑ The inverter is now connected to the power distribution grid (AC).

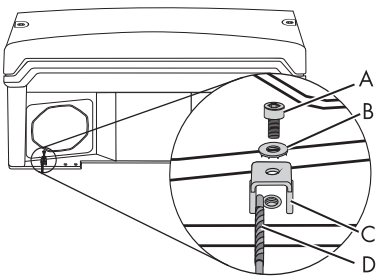
5.2.3 Additional Grounding of the Enclosure

If the installation requires, you can use the ground terminal to connect a second protective conductor or as equipotential bonding.

Procedure

1. Insert the stripped grounding cable (D) under the clamping bracket (C) (max. cross-section 16 mm² or with bootlace ferrule max. 10 mm²).
2. Screw the clamping bracket tight with screw (A) and conical spring washer (B).

   The toothing of the conical spring washer must face toward the clamping bracket.



☑ The inverter's enclosure is additionally grounded.

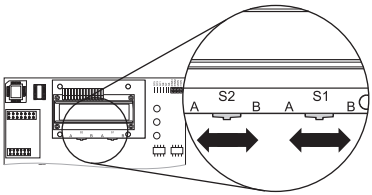
5.3 Setting the Display Language

You can set the language of the display using the switches at the bottom of the display assembly inside the inverter.

When selecting the display language, different switching settings apply to inverters that are set to the Italian national standard CEI 0-21. You can see the standard to which the inverter was set upon delivery on the type label and the supplementary sheet provided with the default settings. For more information, see the Technical Description "Operating Parameters" at www.SMA-Solar.com.

Procedure

1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 50).
2. Set the switches to the required language, as shown below.



   The following switch positions, except for CEI 0-21, apply to all national standards:

Language	Switch S2	Switch S1
German	B	B
English	B	A
French	A	B
Spanish	A	A

   The following switch positions apply to inverters which are set to the national standard CEI 0-21:

Language	Switch S2	Switch S1
Italian	B	A
English	A	A
German	B	B
French	A	B

3. Close the inverter as described in section 7.3 "Closing the Inverter" (page 53).

☑ The display language is set.

5.4 Connecting the PV Array (DC)

5.4.1 Conditions for the DC Connection

Using Y adapters for parallel connection of strings

Y adapters may not be visible within close proximity of the inverter or freely accessible.

- The DC electric circuit may not be interrupted by Y adapters.
- Observe the procedure for disconnecting the inverter as described in section 7.2 "Opening the Inverter" (page 50).

- Requirements for the PV modules of the connected strings:
  - Same type
  - Same quantity
  - Identical alignment
  - Identical tilt
- The connection cables of the PV modules must be equipped with connectors.
  The DC connectors for the DC connection are included in the delivery.
- The following limiting values at the DC input of the inverter must not be exceeded:

Maximum input voltage	Maximum input current
600 V (DC)	26.0 A (DC)

WARNING!

Risk of lethal electric shock or fire.

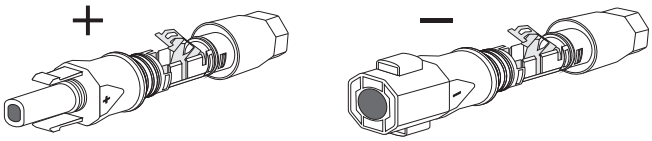
The maximum possible input current per string is limited by the connectors used. If the connectors are overloaded, an electric arc may occur and there is a risk of fire.

- Ensure that the input current for each string does not exceed the maximum through-fault current of the connectors used.

5.4.2 Assembling the DC Connectors

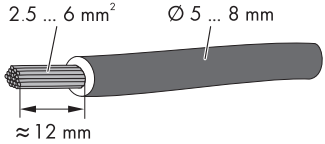
All PV module connection cables must be equipped with the included DC connectors before connecting them to the inverter.

To assemble the DC connectors, proceed as follows. Ensure the connectors have the correct polarity. The DC connectors have the symbols "+" and "–".



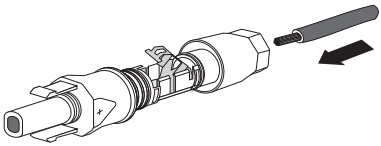
Cable requirements:

- Use a PV1-F cable.

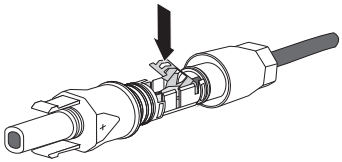


Procedure

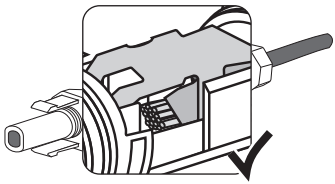
1. Lead the stripped cable all the way into the plug.

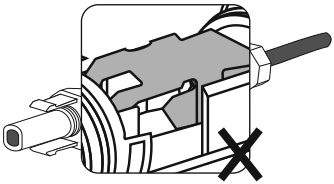
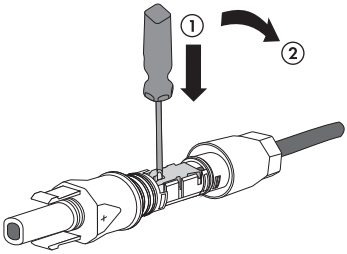


2. Press the clamping bracket down until it audibly snaps into place.

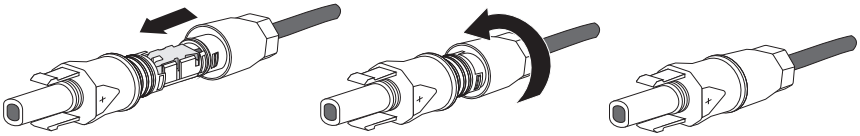


3. Ensure that the cable is correctly positioned:

Result	Measure
☑ If the stranded wire is visible in the chamber of the clamping bracket, the cable is correctly positioned. 	• Proceed to step 4.

Result	Measure
☑ If the stranded wire is **not** visible in the chamber, the cable is not correctly positioned. 	• Loosen the clamping bracket. To do so, insert a 3.5 mm screwdriver into the clamping bracket and lever it out.  • Remove the cable and go back to step 1.

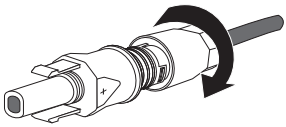
4. Push the threaded joint up to the thread and screw into place with a torque of 2 Nm.



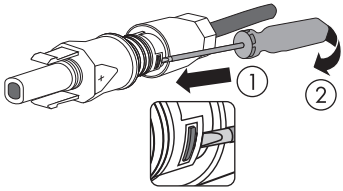
☑ The DC connectors are assembled and can now be connected to the inverter as described in section 5.4.4 "Connecting the PV Array (DC)" (page 32).

5.4.3 Opening the DC Connector

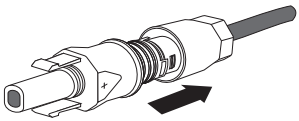
1. Unscrew the screw connection.



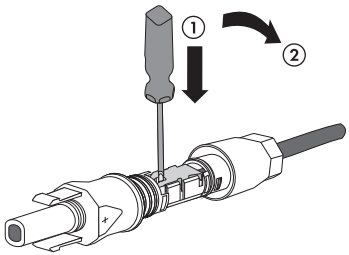
2. Unlocking the DC connector: Insert a 3.5 mm screwdriver into the snap slot on the side and lever it out.



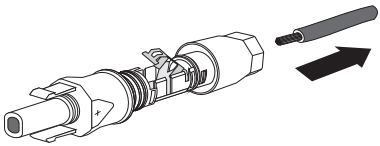
3. Carefully pull the DC connector apart.



4. Loosen the clamping bracket. To do so, insert a 3.5 mm screwdriver into the clamping bracket and lever it out.



5. Remove the cable.



☑ The cable is now removed from the DC connector.

5.4.4 Connecting the PV Array (DC)

DANGER!

Danger to life due to high voltages in the inverter.

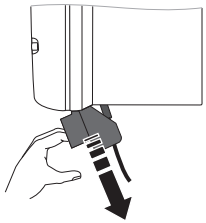
- Before connecting the PV array, ensure that the miniature circuit-breaker is switched off.

NOTICE!

Excessive voltages can destroy the measuring device.

- Only use measuring devices with a DC input voltage range up to at least 1 000 V.

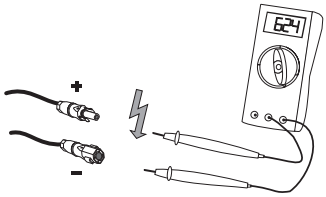
1. Disconnect the miniature circuit-breaker and secure against reconnection.
2. Pull the Electronic Solar Switch downward, slightly towards the wall.



3. Check the connection cable of the PV modules for correct polarity and make sure that the maximum input voltage of the inverter is not exceeded.

   At an ambient temperature above 10°C, the open-circuit voltage of the PV modules must not be more than 90% of the maximum inverter input voltage.

   Otherwise, check the plant design and the PV module connection. If this is not done, the maximum inverter input voltage can be exceeded at low ambient temperatures.



NOTICE!

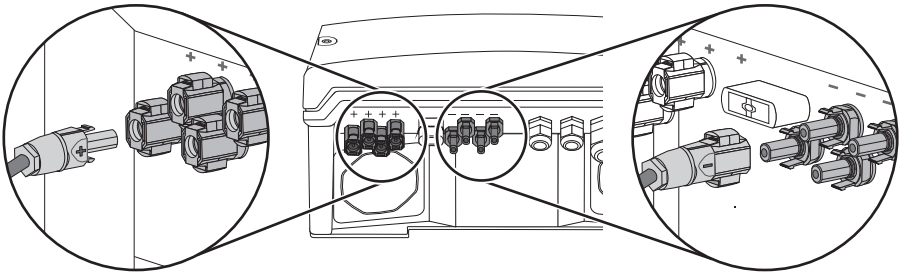
Overvoltage can destroy the inverter.

If the voltage of the PV modules exceeds the maximum input voltage of the inverter, it can be destroyed by overvoltage.

This will void all warranty claims.

- Do not connect strings with an open-circuit voltage greater than the maximum input voltage of the inverter.
- Check the plant design.

4. Check the strings for ground faults as described in section 9.3.1 "Checking the PV Array for Ground Faults" (page 66).
5. Connect the assembled DC connectors to the inverter.
   ☑ The DC connectors click audibly into position.

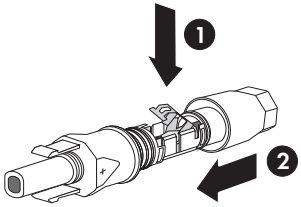


6. In order to seal the inverter, all the DC inputs that are not required have to be closed with DC connectors and sealing plugs:

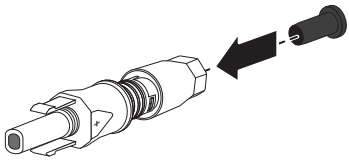
Sealing plugs

- Do **not** plug the sealing plugs **directly** into the DC inputs on the inverter.

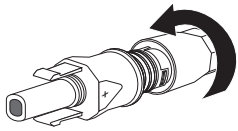
– For unused DC connectors, push down the clamping bracket and push it onto the cable gland.



– Plug the sealing plug into the DC connector.

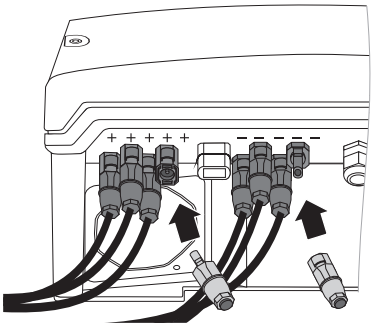


– Tighten the DC connector (torque: 2 Nm).



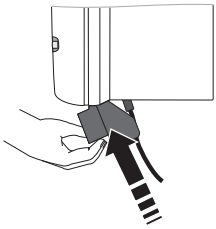
– Insert the DC connectors with sealing plugs into the corresponding DC inputs on the inverter.

☑ The DC connectors click audibly into position.



7. Ensure that all DC connectors are securely in place.

8. Check the Electronic Solar Switch for wear, as described in section 8.3 "Checking the Electronic Solar Switch (ESS) for Wear" (page 59) and attach it firmly.



NOTICE!

Manipulating the connector in the handle can damage the Electronic Solar Switch.

The connector inside the handle must remain movable in order to ensure proper contact. Tightening the screw voids all warranty claims and creates a fire risk.

- Do **not** tighten the connector screw in the Electronic Solar Switch handle.

NOTICE!

Electronic Solar Switch can be damaged.

If it is not correctly connected, the Electronic Solar Switch can be damaged by high voltages.

- Plug the handle firmly onto the jack of the Electronic Solar Switch.
- Make sure that the device is securely in place.

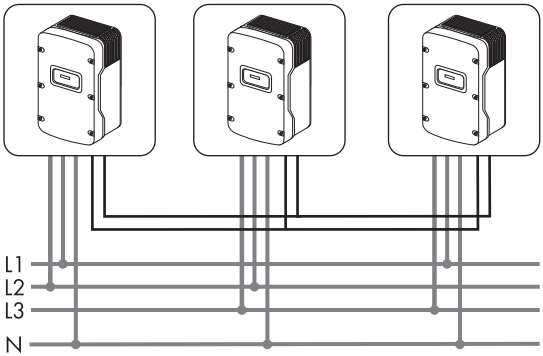
☑ The PV array is connected.

You can now commission the inverter as described in section 6 "Commissioning" (page 47). The following connections are optional.

5.5 Connection of the SMA Power Balancer

The Sunny Mini Central is equipped with the SMA Power Balancer as standard. This enables a circuit connection of 3 Sunny Mini Central inverters to a three-phase feed-in system.

Each of the 3 Sunny Mini Central devices in a group must be connected to a different line conductor of the low-voltage grid (L1, L2 and L3).



By activating this electronic circuit, you can stipulate how the other 2 Sunny Mini Central inverters are to react if there is a device fault with the 3rd Sunny Mini Central or there is a line voltage fault in its line conductor.

Three-phase grid connection

For further information on this subject, see the Technical Information "Three phase connection with Sunny Mini Central" in the download area at www.SMA-Solar.com.

The connections for the SMA Power Balancer are galvanically isolated from the rest of the Sunny Mini Central electronic circuit.

5.5.1 Configuration

If the national standard VDE-AR-N4105-MP or VDE-AR-N4105-HP is set, the SMA Power Balancer is activated by default and set to operating mode "PowerGuard" in SMC 4600A-11, SMC 5000A-11 and SMC 6000A-11. All other national standards deactivate the SMA Power Balancer by default in SMC 4600A-11, SMC 5000A-11 and SMC 6000A-11.

The SMA Power Balancer is always deactivated by default in SMC 4600A, SMC 5000A and SMC 6000A, regardless of the national standard set.

The SMA Power Balancer can only be activated or configured using a communication product. To change the "PowerBalancer" parameter, you need a personal access code – the so-called SMA Grid Guard Code. The application form for the personal access code is available in the download area at www.SMA-Solar.com, in the "Certificate" category of the respective inverter.

The configuration options are described below.

Configuration Options

There are 4 different configuration options for the "PowerBalancer" parameter.

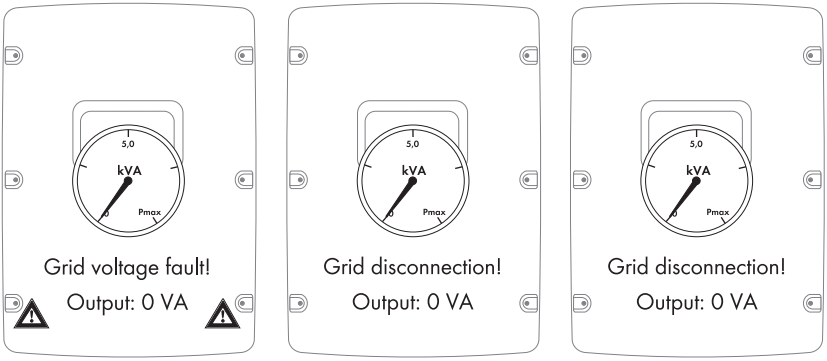
Local connection requirements

Select the respective setting and always observe the local connection requirements and provisions of your grid operator.

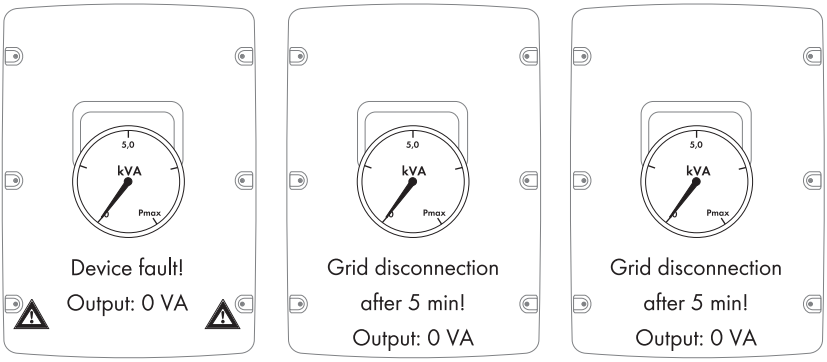
- **FaultGuard**

  This operating mode allows for the implementation of a three-phase line voltage monitoring, which also reacts to device faults.

  – If 1 of the 3 inverters indicates a **line voltage fault** and stops feeding in, the other 2 inverters also disconnect from the power distribution grid immediately.



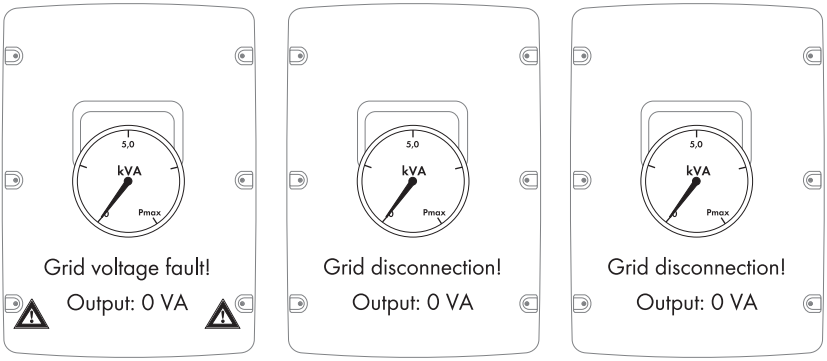
  – If 1 of the 3 inverters indicates a **device fault** and stops feeding in, the other 2 inverters also disconnect from the power distribution grid 5 minutes later.



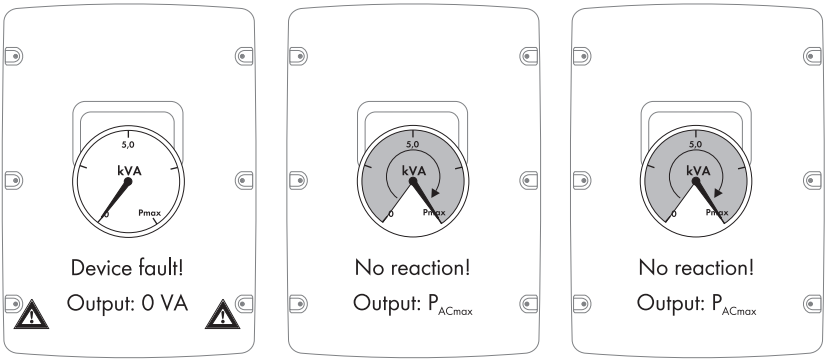
- **PhaseGuard**

  This operating mode allows for the implementation of a three-phase grid voltage monitoring.

  – If 1 of the 3 inverters indicates a **line voltage fault** and stops feeding in, the other 2 inverters also disconnect from the power distribution grid automatically.



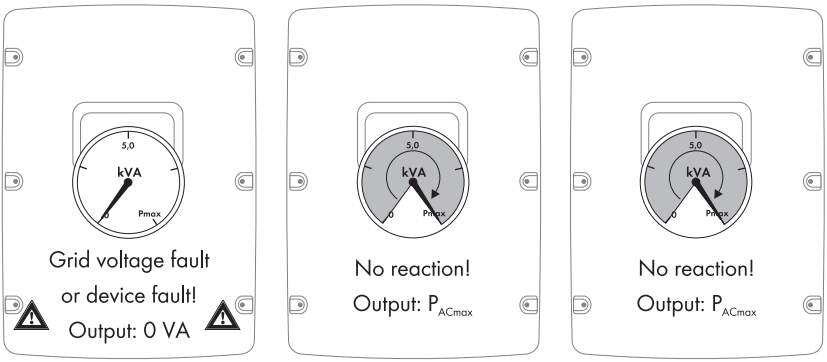
  – If 1 of the 3 inverters indicates a **device fault** and stops feeding in, the other 2 inverters are not affected and continue to feed in at full power.



- **Off**

  The SMA Power Balancer is deactivated (default setting).

  – In the event of a **device fault** or **line voltage fault** at an inverter, only this inverter is disconnected from the power distribution grid and the other two inverters continue to run at an undiminished power level.



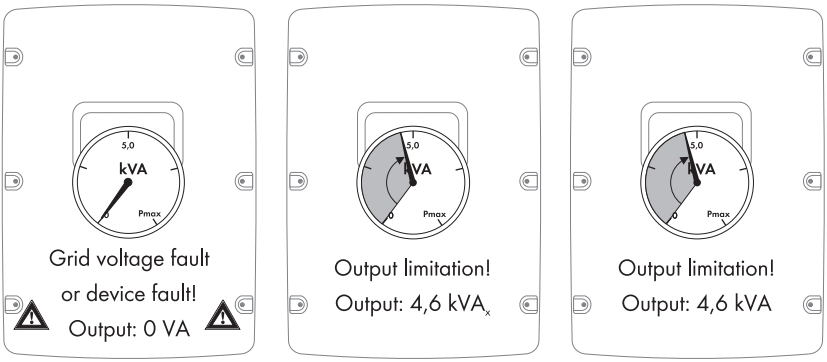
- **PowerGuard**

  This setting can be selected if the entire PV plant only consists of three 3 Sunny Mini Central inverters and in the event of a malfunction, the unbalanced load should be limited to 4.6 kVA over a 10-minute average.

Different unbalanced load limitation for SMC 6000A-11 inverters for Italy

The unbalanced load for SMC 6000A-11 inverters set to the national standard CEI 0-21 is limited to 6 kVA over a 10-minute average.

  – If 1 of the 3 inverters indicates a **line voltage fault** or **device fault** and stops feeding in, the other 2 inverters automatically limit their power to 4.6 kVA over a 10-minute average.



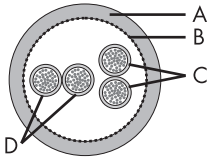
5.5.2 Cabling

Cable Requirements

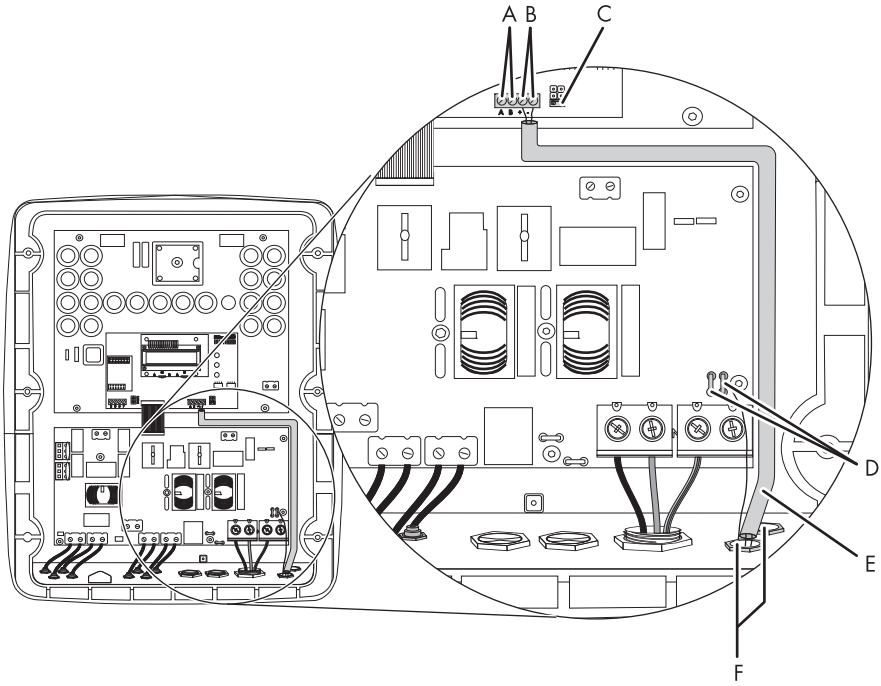
For cabling the SMA Power Balancer, use a "LiYCY" cable, structured as shown here:

- Indoor: LiYCY 2 x 2 x 0.25
- Outdoor: Li-2YCYv 2 x 2 x 0.25

Position	Designation
A	Flexible insulation
B	Shielding
C	Twisted pair 2 (2 x 0.25 mm²)
D	Twisted pair 1 (2 x 0.25 mm²)



Overview of the Connection Area



Object	Description
A	Screw terminals for the wire bridge
B	Screw terminals for connecting the cables
C	Jumper slot
D	Flat male tab for grounding the cable shield
E	Silicone tube/cable route
F	Cable glands

Procedure

1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 50).
2. Insert the cable into each inverter.

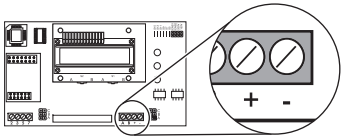
   Use 1 of the 2 enclosure openings (F) on the right-hand side.

DANGER!

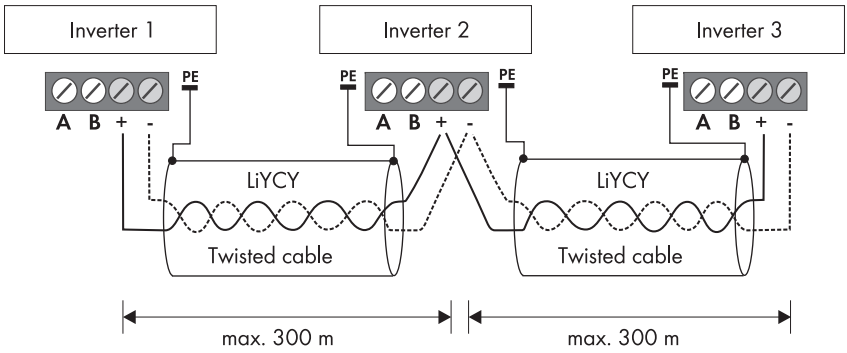
Danger to life through high voltage if there is a fault with the SMA Power Balancer cable.

- Sheath the positive and negative cable conductors in each inverter using the enclosed silicone tube.
- Cut the silicone tube to the required length.
- The silicone tube must completely cover the cable inside the inverter enclosure.

3. Draw the cable along the cable route (E) as far as the terminal block (B).
4. Ground the cable shield in each inverter at the PE terminal (D).
5. Sheath the positive and negative cable conductors in each inverter with bootlace ferrules.
6. Connect the positive and negative pole to the corresponding screw terminals.



7. In order to connect the 3 inverters together, connect the positive and negative conductors from the 2 other inverters to the terminal block of the middle inverter.



The cable length between 2 inverters may not exceed 300 m.

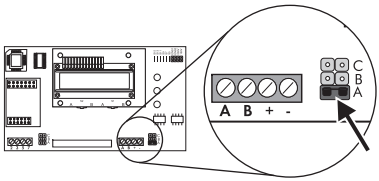
8. **Only** in the **middle** inverter (the one with 2 wires for each terminal), insert one of the provided jumpers into the lowest of the slots as depicted on the right.

   Do **not** plug the jumpers in the bottom slot of the 2 other inverters.

   or

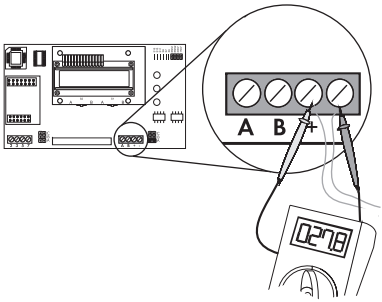
   Bridge the "A" and "B" screw terminals on the **middle** inverter with a wire bridge.

   Do **not** bridge the "A" and "B" screw terminals in the 2 other inverters.



9. Measure the resistance between the terminal block's positive and negative poles in the **middle** inverter.

   ☑ If the resistance is approximately 27.8 k Ω (±370 Ω), the SMA Power Balancer has been connected correctly. Otherwise, check the cabling.



10. Close all inverters as described in section 7.3 "Closing the Inverter" (page 53).

Connection with a Sunny Mini Central 9000TL, 10000TL or 11000TL

In order to be able to connect the SMA Power Balancer with a Sunny Mini Central 9000TL, 10000TL or 11000TL, the Sunny Mini Central 4600A, 5000A or 6000A must be equipped with a special plug. 3 inverters are then connected together with a special connection cable.

You can order the plug and the connection cable from SMA Solar Technology AG or your specialty retailer. Section 12 "Accessories" (page 80) contains a list of the order numbers.

5.5.3 Testing the Functioning

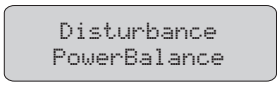
To test whether the SMA Power Balancer operates correctly, proceed as follows.

1. Select the "PhaseGuard" setting of the "PowerBalancer" parameter for all 3 inverters.
2. Check whether all inverters in the group are feeding the power distribution grid normally.

   ☑ If the green LED lights up steadily or if the display message pictured on the right appears, proceed to step 3.

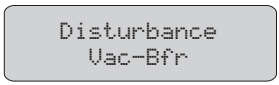
   or

   ☑ If all inverters in this group show the display message pictured on the right: Check the installation of the SMA Power Balancer and contact the SMA Service Line, if necessary.

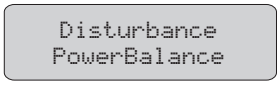
   

3. Switch off the miniature circuit-breaker for 1 of the 3 inverters.

- The inverter with a deactivated miniature circuit-breaker then indicates a line voltage fault with the display message pictured on the right ("Bfr" and "Srr" are irrelevant).

- The other 2 inverters then also disconnect themselves from the power distribution grid with the display message pictured on the right.

- Both inverters subsequently switch to "Balanced" mode.

  ☑ If the inverters react as described above, the functionality test has been completed successfully. Otherwise, check the configuration.

4. If applicable, reset the "PowerBalancer" parameter to the desired setting in all inverters.
5. Switch on the miniature circuit-breaker again.

☑ The functionality test has been completed.

5.6 Communication

The inverter is equipped with a slot for communication interfaces in order to communicate with special data loggers (e.g., Sunny WebBox) or a PC with corresponding software (e.g., Sunny Data Control or Sunny Explorer).

Refer to the respective communication interface manual for a detailed wiring diagram and an installation description for the interface.

The inverter's active power can be limited or its displacement power factor can be set externally using the Power Reducer Box from SMA Solar Technology AG. Detailed information on the Power Reducer Box is available in its Technical Description at www.SMA-Solar.com.

5.7 Setting the Grid and Country Parameters

Changing grid-relevant and country parameters

To change grid-relevant parameters, you need a personal access code – the so-called SMA Grid Guard Code. The application form for the personal access code is available in the download area at www.SMA-Solar.com, in the "Certificate" category of the respective inverter.

Ensure that you discuss the changes to these parameters with your grid operator.

A detailed description of the operating parameters for the inverter is available in the download area at www.SMA-Solar.com in the category "Technical Description" of the respective inverter.

5.7.1 Setting the Installation Country

Using the "Default" parameter, you can set the installation country and/or the grid connection standard valid for the country via a communication product (e.g., Sunny WebBox) or a PC with corresponding software (e.g., Sunny Data Control or Sunny Explorer). This, however, is only required if the inverter was originally ordered for another country. You can see the standard to which the inverter was set upon delivery on the type label and on the included supplementary sheet with the default settings.

5.7.2 Setting Stand-alone Grid Operation

To operate the inverter in a stand-alone grid system with Sunny Island, you must set the "Default" parameter to stand-alone grid ("OFF-Grid") operation.

You have several possibilities to set the inverter to stand-alone grid operation:

- Setting via Sunny WebBox

  or

- Setting via Sunny Data Control or Sunny Explorer

DANGER!

Danger to life due to high voltages in the event of outage of the power distribution grid.

If you set the inverter to stand-alone grid operation, it does not fulfill any country-specific standards and guidelines. If there is a power distribution grid outage, there is consequently a danger of feedback.

- **Never** operate the inverter directly on the power distribution grid when set to stand-alone grid operation.

5.7.3 Additional Country Parameters

Requirement for the setting

Set the installation country as described in section 5.7.1 "Setting the Installation Country" (page 45) before setting the country parameter described here.

The deactivation criteria (voltage, frequency, impedance) are specified via country parameters as with all Sunny Mini Central inverters.

The additional default country parameter "MVtgDirective" expands the deactivation limits of the inverter for voltage and frequency to a maximum/minimum. This country setting may only be selected if the PV plant or the inverter is operated with external three-phase decoupling protection, which will automatically disconnect the inverter from the power distribution grid if non-permissible voltage and frequency values occur. Device protection is still guaranteed.

DANGER!

Risk of lethal electric shock if external decoupling protection is missing.

At country setting "MVtgDirective", the inverter may only be operated with an external three-phase decoupling protection device which complies with the country-specific requirements.

Without such external decoupling protection, the inverter will not disconnect from the power distribution grid when the standard requirement is exceeded.

- Install external three-phase decoupling protection.

6 Commissioning

6.1 Commissioning the Inverter

1. Check the following requirements before commissioning:
   - The inverter is securely in place.
   - AC cables are correctly connected (power distribution grid).
   - DC cables (PV strings) are completely connected.
   - Unused DC inputs are closed using the corresponding DC connectors and sealing plugs.
   - The enclosure lid is securely screwed in place.
   - The Electronic Solar Switch is securely plugged.
   - The miniature circuit-breaker is correctly laid out.
2. Switch on the miniature circuit-breaker.
   ☑ All 3 LEDs are lit or flashing: the startup phase is starting.
   ☑ Green LED is lit: commissioning was successful.

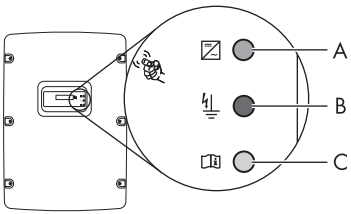
   or

   ☑ Green LED flashes in case of insufficient irradiation: grid connection conditions have not yet been reached. Wait for sufficient irradiation.

   or

   ☑ The red or yellow LED is lit or flashing: there is a fault. Proceed to step 3.

A	Green LED	operation
B	Red LED	ground fault or varistor defective
C	Yellow LED	Fault



Self-test in accordance with CEI 0-21 during initial start-up of SMC 6000A-11 (applies to Italy only)

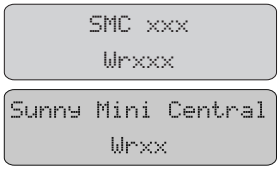
The Italian standard CEI 0-21 prescribes that an inverter can only operate on the electricity grid after the disconnection times for overvoltage, undervoltage, minimum frequency and maximum frequency have been checked.

Start the self-test as described in section 6.3 "Only for Italy: Starting the Self-Test in Accordance with CEI 0-21" (page 49). The test takes approx. 8 minutes.

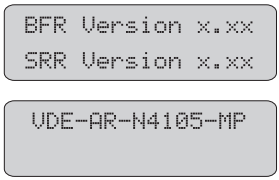
3. Read section 9 "Troubleshooting" (page 60) and if necessary, eliminate the error or fault.

6.2 Display Messages During the Startup Phase

- After commissioning, the inverter displays the device type in the startup phase.



- After 5 seconds or when you tap again on the enclosure lid, the firmware version of the internal processors is displayed by the inverter.
- After a further 5 seconds or when you tap again, the configured country standard is displayed by the inverter (example: "VDE-AR-N4105-MP").



Viewing display messages again

If you want to view the display messages of the startup phase again while in normal operation, tap the enclosure lid twice in quick succession.

6.3 Only for Italy: Starting the Self-Test in Accordance with CEI 0-21

The self-test only applies to inverters of type SMC 6000A-11 which are commissioned in Italy.

The Italian standard requires that all inverters feeding into the electricity grid perform a self-test in accordance with CEI 0-21. During the self-test, the inverter will consecutively check the reaction times for overvoltage, undervoltage, maximum frequency and minimum frequency.

The self-test changes the upper and lower trip-limit values for each protective function on a linear basis for frequency monitoring and voltage monitoring. As soon as the measured value exceeds the permitted trip-limit value, the inverter disconnects from the electricity grid. In this way, the inverter determines the reaction time up to disconnection and the self-test is performed.

After the self-test has been completed, the inverter automatically switches back into feed-in operation, resets the original calibration values and connects to the electricity grid.

Requirements:

- Configured country data set: **CEI0-21 Int / CEI 0-21 Intern** or amended country data set **trimmed / Special setting** based on one of the country data sets mentioned above.
- A report for entering the test results must be available.
- The inverter must be in operation and in the start-up phase.

1. As soon as the configured country data set appears in the display, tap once on the display.
   ☑ In the display, the question as to whether the self-test can be started appears: **Avvio Autotest**.
2. Tap on the display within 20 seconds and enter the test results that follow into the test report.
   ☑ The self-test starts.
   ☑ The inverter displays the results of the individual tests for overvoltage, undervoltage, maximum frequency and minimum frequency. The results are displayed three times in succession for ten seconds each.

Example: Display messages for overvoltage test

- Test name: **Autotest Vac Max**
- Current line voltage: **Vac Max 245,0 V**
- Disconnection value: **Valore di soglia con 233,0 V**
- Calibration value: **Valore di taratura 276,0 V**
- Reaction time: **Tempo di intervento 0,08 S**

7 Opening and Closing

7.1 Safety

DANGER!
Risk of lethal electric shock.

Before opening the inverter, observe the following:

- Ensure that no voltage is present on the AC side.
- Ensure that neither voltage nor current is present on the DC side.

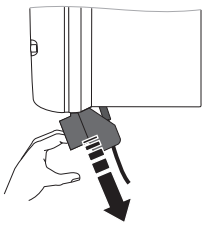
NOTICE!
Electrostatic discharges can damage the inverter.

The internal component parts of the inverter can be irreparably damaged by electrostatic discharge.

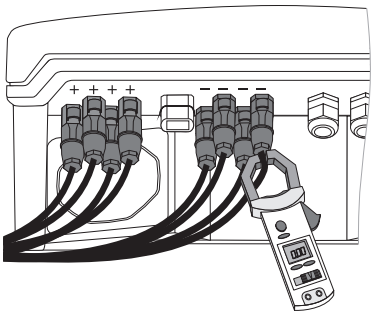
- Ground yourself before touching a component part.

7.2 Opening the Inverter

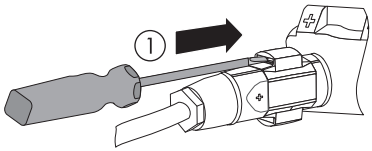
1. Disconnect the miniature circuit-breaker and secure against reconnection.
2. Pull the Electronic Solar Switch downward, slightly towards the wall.

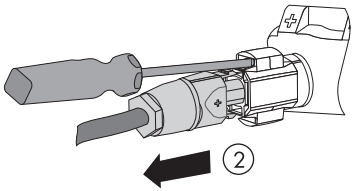


3. Use a current probe to ensure that no current is present in any of the DC cables.
   ☑ If current is present, check the installation.

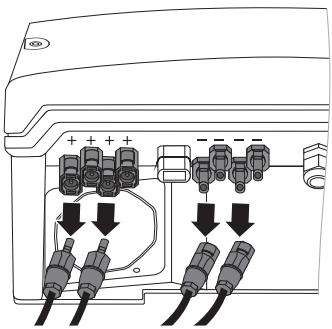


4. Unlock and disconnect all DC connectors. To do this, insert the screwdriver into one of the side slots (blade width: 3.5 mm) and pull the DC connectors straight down. Do not pull on the cable while doing this.





☑ All DC connectors are disconnected from the inverter. The inverter is entirely disconnected from the PV array.



DANGER!

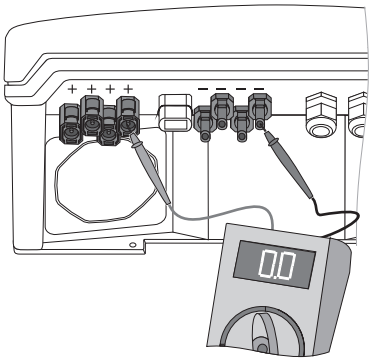
Danger to life due to high voltages in the inverter.

The capacitors in the inverter require 5 minutes to discharge.

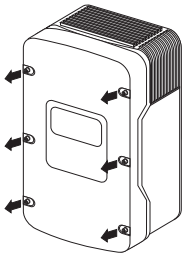
- Wait 5 minutes before opening the inverter.

5. Ensure that no voltage is present at the DC plugs on the inverter.

☑ If voltage is present, check the installation.

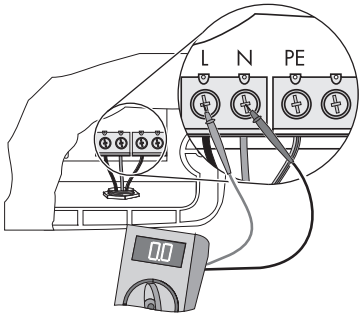


6. Loosen all 6 screws of the enclosure lid and remove the enclosure lid from the front.



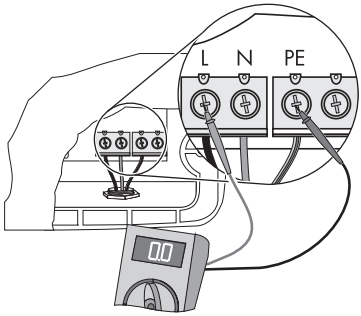
7. Verify the absence of voltage L with respect to N at the AC terminal with an appropriate measuring device.

   ☑ If voltage is present, check the installation.



8. Verify the absence of voltage L with respect to PE at the AC terminal with an appropriate measuring device.

   ☑ If voltage is present, check the installation.



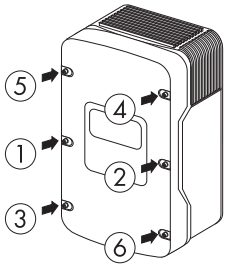
☑ The inverter is open and no voltage is present.

7.3 Closing the Inverter

1. Secure the enclosure lid with the 6 screws and the corresponding conical spring washers.

   Tighten the screws with 6 Nm torque in the order shown in the figure on the right. The toothing of the conical spring washers must point toward the enclosure lid.

   The scope of delivery of the inverter includes another spare screw and conical spring washer.



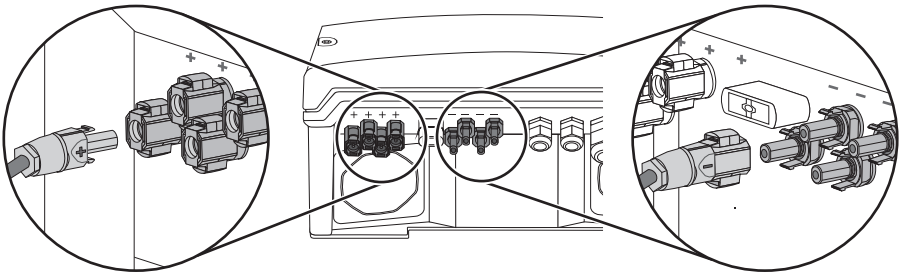
DANGER!

Danger to life due to enclosure lid carrying voltage.

The grounding of the enclosure lid is ensured by the conical spring washers.

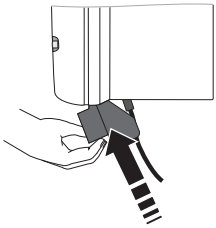
- Attach the conical spring washers for all 6 screws with the toothing facing toward the enclosure lid.

2. Check the DC connectors for correct polarity and connect them.
   To unlock the DC connectors, see section 7.2 "Opening the Inverter" (page 50).



3. Close all the DC inputs that are not needed as described in section 5.4.4 "Connecting the PV Array (DC)" (page 32) to seal the inverter.

4. Check the Electronic Solar Switch for wear, as described in section 8.3 and attach it firmly.



NOTICE!

Manipulating the connector in the handle can damage the Electronic Solar Switch.

The connector inside the handle must remain movable in order to ensure proper contact. Tightening the screw voids all warranty claims and creates a fire risk.

- Do not tighten the connector screw in the Electronic Solar Switch handle.

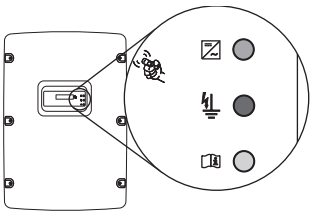
NOTICE!

Electronic Solar Switch can be damaged.

If it is not correctly connected, the Electronic Solar Switch can be damaged by high voltages.

- Plug the handle firmly onto the jack of the Electronic Solar Switch.
- Make sure that the device is securely in place.

5. Switch on the miniature circuit-breaker.
6. Check whether the display and the LEDs indicate a normal operating state (see section 6 "Commissioning" (page 47)).



☑ The inverter is now closed and in operation.

8 Maintenance and Cleaning

8.1 Cleaning the Inverter

If the inverter is dirty and the visibility of the operating data and operating states of the inverter is only limited, clean the enclosure lid, the display and the LEDs with a damp cloth. Do not use any corrosive substances (e.g., solvents or abrasives) for cleaning.

8.2 Checking Heat Dissipation

8.2.1 Cleaning the Fans

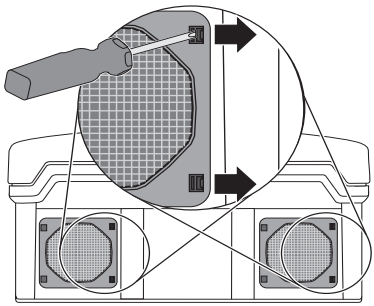
If the fan guards are soiled with loose dust, they can be cleaned using a vacuum cleaner.
If you do not achieve satisfactory results with a vacuum cleaner, dismantle the fans for cleaning.

Procedure

1. Disconnect the inverter from both the DC and AC sides as described in section 7.2 "Opening the Inverter" (page 50).
2. Wait for the fans to stop rotating.

Cleaning the Fan Guards

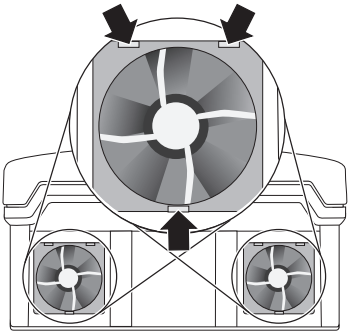
3. Removing the fan guards:
   - Press both latches on the right edge of the fan guard to the right using a screwdriver and loosen from the retainer.
   - Carefully remove the fan guard.



4. Clean the fan guards with a soft brush, a paint brush, a cloth or compressed air.

Cleaning the Fans

5. Press the front latches backward and the rear latch forward.



6. Remove the fan by pulling it slowly and carefully downward.
7. Unlock and remove the plug.

   The fan cables are long enough that you can lift the fans far enough out to disconnect the internal plug in the inverter.
8. Remove the fan.
9. Clean the fan with a soft brush, a paint brush, or a damp cloth.

NOTICE!

Damage to the fan through use of compressed air.

- Do not use compressed air to clean the fan. This can damage the fan.

10. After cleaning, reassemble everything in reverse order.

☑ The fans are cleaned.

11. Check the functioning of the fans as described in the following section.

8.2.2 Checking the Fans

You can check that the fans are working in 2 ways:

- Set the "Fan-Test" parameter to "1" in the installer mode using Sunny Data Control, Sunny Explorer or Sunny WebBox.

  or

- Plug the provided jumper into the system control board.

Setting Parameters

1. Request the installer password from the SMA Service Line (contact: see Page 81).
2. Set the "Fan-Test" parameter to "1" in the installer mode.
3. Check the fans' air flow.

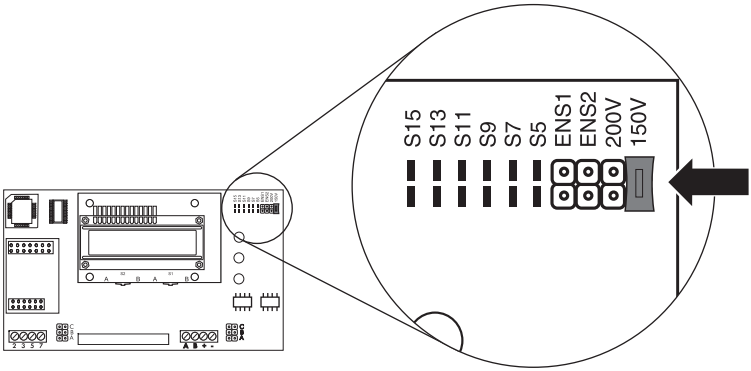
   The inverter takes cooling air in from underneath and then blows it back out on the upper sides. Listen for any unusual noise, which could indicate incorrect installation or that the fans are faulty.
4. After checking the fans, set the "Fan-Test" parameter back to "0".

☑ The test of the fans has been completed.

Plugging the Jumper

The inverter recognizes the jumper only after the system has been restarted (i.e. all LEDs must have gone out before a restart).

1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 50).
2. Plug the provided jumper in the slot on the system control board as shown below.



3. Close the inverter as described in section 7.3 "Closing the Inverter" (page 53).

4. Check the fans' air flow.

   The inverter takes cooling air in from underneath and then blows it back out on the upper sides. Listen for any unusual noise, which could indicate incorrect installation or that the fans are faulty.

5. After checking the fans, remove the jumper. Open and close the inverter as described in section *7* "Opening and Closing" (page 50).

☑ The test of the fans has been completed.

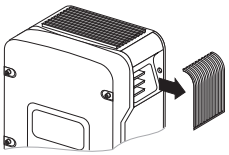
8.2.3 Cleaning the Fan Guards

The inverter takes cooling air in from underneath via the fans and blows it out again through the fan guards on the upper sides. Clean the fan guards if they are dirty.

Procedure

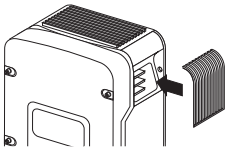
1. Remove the fan guards.

   Insert your finger above in the space between the fan guard and the enclosure and remove the fan guard to the side.



2. Clean the fan guards with a soft brush, a paint brush, or compressed air.
3. Re-attach the fan guards to the inverter.

   The fan guards must be attached according to the inside inscription ("links/left" and "rechts/right").



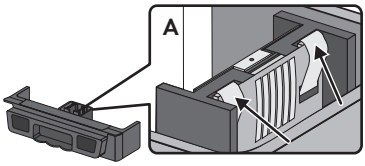
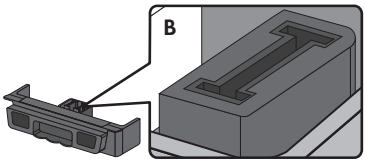
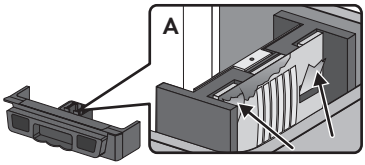
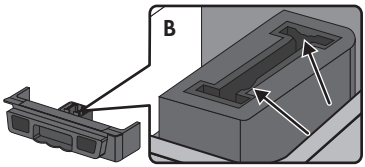
NOTICE!

Risk of damage to the inverter through intrusion of insects.

- The fan guards must not be removed permanently, because otherwise the device is not protected against insects entering.

8.3 Checking the Electronic Solar Switch (ESS) for Wear

Check the Electronic Solar Switch for wear before plugging it in. Depending on the shape of the Electronic Solar Switch, you can estimate the wear on either the metal tongues (shape A) or on the plastic (shape B).

Result	Measure
☑ The metal tongues in the Electronic Solar Switch are undamaged and not discolored (A).  **or** ☑ The plastic in the Electronic Solar Switch is undamaged (B). 	1. Securely attach the Electronic Solar Switch handle. 2. Commission the inverter as described in section 6 "Commissioning" (page 47).
☑ The metal tongues in the Electronic Solar Switch have a brown discoloration or are burned through (A).  **or** ☑ The plastic in the Electronic Solar Switch shows thermal deformation (B). 	The Electronic Solar Switch can no longer reliably disconnect the DC side. 1. Replace the Electronic Solar Switch handle before attaching it again (for the order number, see section 12 "Accessories" (page 80)). 2. Recommission the inverter as described in section 6 "Commissioning" (page 47).

9 Troubleshooting

If the inverter displays other blink codes or error messages than those described below, contact the SMA Service Line.

You will also find a description of display messages during operation, status messages and measurement channels in the user manual provided.

Do not perform any repairs that are not described here and take advantage of the 24-hour replacement service (inverter ready for shipping and handed over to a freight-forwarding company within 24 hours) and the SMA Solar Technology AG repair service instead.

9.1 Blink Codes

Green	Red	Yellow	Status
flashing	flashing	flashing	OK (startup phase)
is permanently lit	is not lit	is not lit	OK (feed-in operation)
	is permanently lit	is not lit	ground fault or varistor defective
		is permanently lit	OK (initialization)
is flashing quickly (3 x per second)	is not lit	is not lit	OK (stop)
	is permanently lit	is not lit	ground fault or varistor defective
is flashing slowly (1 x per second)	is not lit	is not lit	OK (waiting, grid monitoring)
goes out briefly (approx. 1 x per second)	is permanently lit	is not lit	ground fault or varistor defective
	is not lit	is not lit	OK (derating)
is not lit	is not lit	is not lit	OK (nighttime deactivation or Electronic Solar Switch not connected)
		is lit/flashing	fault
	is permanently lit	is not lit	ground fault or varistor defective
		is lit/flashing	ground fault or varistor defective and fault

9.2 Error Messages

When a fault occurs, the inverter generates a message which depends on the operating mode and the type of the fault detected.

Message	Description and corrective measure
!PV-Overvoltage! **!DISCONNECT DC!**	Overvoltage at DC input. Overvoltage can destroy the inverter.
	Corrective measures Disconnect the inverter from the power distribution grid immediately. 1. Disconnect the miniature circuit-breaker. 2. Remove the Electronic Solar Switch. 3. Remove all DC connectors. 4. Check the DC voltage: – If the DC voltage is above the maximum input voltage, check the PV plant design or contact the PV array installer. – If the DC voltage is below the maximum input voltage, reconnect the inverter to the PV array as described in section 5.4.4 "Connecting the PV Array (DC)" (page 32). If the message occurs again, disconnect the inverter again and contact the SMA Service Line (see section 13 "Contact" (page 81)).
ACVtgRPro	The 10-minute average line voltage is no longer within the permissible range. This can be caused by either of the following: • The line voltage at the terminal is too high. • The grid impedance at the terminal is too high. The inverter disconnects to assure compliance with the power quality of the power distribution grid.
	Corrective measures Check the line voltage at the terminal of the inverter: • If, due to the local grid conditions, the line voltage is 253 V or more, ask the grid operator whether the voltage at the feed-in point can be adjusted, or whether they would agree to an alteration of the limiting value of parameter "ACVtgRPro" for power quality monitoring. • If the line voltage is continually within the tolerance range and this error message is still displayed, contact the SMA Service Line.
Bfr-Srr	Internal measurement comparison fault or hardware defect.
	Corrective measures • If this fault occurs frequently, contact the SMA Service Line.

Message	Description and corrective measure
Derating	The "Derating" operating state is a normal operating state which may occur occasionally and can have several causes. Once the inverter enters the "Derating" operating state, it will display the "Derating" warning until the next total disconnection of the device (at the end of the day).
	Corrective measures • Check the heat dissipation as described in section 8.2 "Checking Heat Dissipation" (page 55).
EEPROM	Transition fault while data is being written or read from EEPROM. The data is not relevant for safe operation. • This fault has no effect on the performance of the inverter.
EEPROM dBh	EEPROM data is defective. The inverter has switched itself off because the loss of data has disabled important functions of the inverter.
	Corrective measures • Contact the SMA Service Line.
EeRestore	One of the duplicate records in the EEPROM is defective and has been reconstructed without loss of data. • This error message only serves to inform you and has no effect on the performance of the inverter.
Fac-Bfr **Fac-Srr** **FacFast**	The power frequency is no longer within the permissible range ("Bfr"/"Srr"/"Fast" is an internal message that has no meaning for the user). The inverter disconnects itself from the power distribution grid for safety reasons.
	Corrective measures • Check the grid connection and contact the grid operator if necessary. • If the power frequency is within the tolerable range, but "Fac-Bfr", "Fac-Srr" or "FacFast" faults are still displayed, contact the SMA Service Line.
K1-Close **K1-Open**	Error during relay test.
	Corrective measures • If this fault frequently occurs or occurs several times consecutively, contact the SMA Service Line.
Imax	Overcurrent on the AC side. This message is displayed if the current in the AC grid is higher than specified.
	Corrective measures • Check the plant design and grid conditions.

Message	Description and corrective measure
MSD-Fac	Internal measurement comparison fault or hardware defect.
	Corrective measures • If this fault occurs frequently, contact the SMA Service Line.
MSD-Vac	Internal measurement comparison fault or hardware defect.
	Corrective measures • If this fault occurs frequently, contact the SMA Service Line.
MSD-Timeout	Internal measurement comparison fault or hardware defect.
	Corrective measures • If this fault occurs frequently, contact the SMA Service Line.
OFFSET	The "OFFSET" operating state is a normal operating state that occurs prior to grid monitoring. If "OFFSET" is displayed as an error, there is a fault in the data logging.
	Corrective measures • If this fault occurs frequently, contact the SMA Service Line.
PowerBalance	The Sunny Mini Central is part of a three-phase system with 2 further Sunny Mini Central inverters equipped with the SMA Power Balancer for preventing unbalanced loads. The operating parameter "PowerBalancer" is set to "PhaseGuard" or "FaultGuard".
	Corrective measures • For detailed descriptions of the operation modes "PhaseGuard" and "FaultGuard", refer to section 5.5 "Connection of the SMA Power Balancer" (page 36).
Riso	The electrical insulation between the PV plant and ground is defective. The resistance between the DC plus and/or DC minus connection and ground is outside the defined limit range.
	Corrective measures • Check the insulation of the PV plant. • Check the PV plant for ground faults as described in section 9.3.1 "Checking the PV Array for Ground Faults" (page 66).
ROM	The inverter's firmware is faulty.
	Corrective measures • If this fault occurs frequently, contact the SMA Service Line.
Trafo-Temp-F	Temperatures in the transformer have exceeded the acceptable limit. The inverter stops feeding the grid until the temperature lies within the acceptable range.
	Corrective measures • If this fault occurs frequently, check the heat dissipation.

Message	Description and corrective measure
Trafo-Temp-W	If the transformer reaches an inadmissibly high temperature, the inverter stops feeding the grid until the transformer has reached an admissible temperature and the plant can begin feeding the grid again. The "Trafo-Temp-W" warning is displayed until the device is completely disconnected.
	Corrective measures • Check the heat dissipation of the inverter.
Shutdown	Temporary inverter fault.
	Corrective measures • Contact the SMA Service Line.
Vac-Bfr **Vac-Srr**	The line voltage is no longer within the permissible range ("Bfr" or "Srr" is an internal message of no relevance for the user). This fault can be caused by any of the following conditions: • Power distribution grid disconnected (miniature circuit-breaker, fuse) • AC cable is broken • AC cable is highly resistive The inverter disconnects itself from the power distribution grid for safety reasons.
	Corrective measures • Check the line voltage and connection on the inverter. • If the line voltage lies outside the acceptable range because of local grid conditions, ask the grid operator if the voltages can be adjusted at the feed-in point or if they agree to changes in the values of the monitored operating limits (operating parameters: Vac-Min and Vac-Max). • If the line voltage lies within the tolerance range, yet "Vac-Bfr" or "Vac-Srr" faults are still displayed, contact the SMA Service Line.

Message	Description and corrective measure
UpvMax	Overvoltage at DC input. The inverter may be damaged.
	Corrective measures Disconnect the inverter from the power distribution grid immediately. 1. Disconnect the miniature circuit-breaker. 2. Remove the Electronic Solar Switch. 3. Remove all DC connectors. 4. Check the DC voltage: – If the DC voltage is above the maximum input voltage, check the PV plant design or contact the PV array installer. – If the DC voltage is below the maximum input voltage, reconnect the inverter to the PV array as described in section 5.4.4 "Connecting the PV Array (DC)" (page 32). If the message occurs again, disconnect the inverter again and contact the SMA Service Line (see section 13 "Contact" (page 81)).
Watchdog **Watchdog Srr**	Internal program run fault.
	Corrective measures • If this fault occurs frequently, contact the SMA Service Line.

9.3 Red LED is Permanently Lit

If the red status display LED is permanently lit during operation, there is a ground fault in the PV array or at least one of the varistors for overvoltage protection is defective.

Procedure

1. Check for ground faults in the PV array as described in section 9.3.1 "Checking the PV Array for Ground Faults" (page 66).
2. If the red LED continues to be lit, check the varistors as described in section 9.3.2 "Checking the Function of the Varistors" (page 68).

9.3.1 Checking the PV Array for Ground Faults

1. Disconnect the inverter from both the DC and AC sides as described in section 7.2 "Opening the Inverter" (page 50).

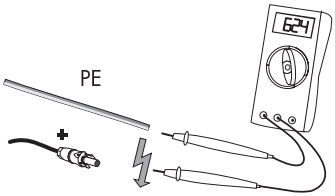
DANGER!
Risk of lethal electric shock.

- Only touch the cables of the PV array on their insulation.
- Do not connect strings with ground faults to the inverter.

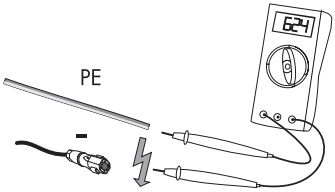
NOTICE!
Excessive voltages can destroy the measuring device.

- Only use measuring devices with a DC input voltage range up to at least 1 000 V.

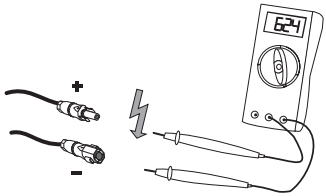
2. Measure the voltages between the positive pole of each string and the ground potential (PE).



3. Measure the voltages between the negative pole of each string and the ground potential (PE).



4. Measure the voltages between the positive and negative poles of each string.



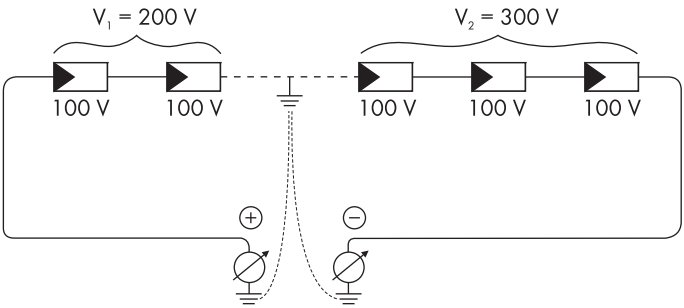
☑ A ground fault exists if the measured voltages are stable and the sum of the voltages from the positive pole to the ground potential and from the negative pole to the ground potential of a string is approximately equal to the voltage between the positive and negative poles.

Result	Measure
☑ You have found **a ground fault**.	• The installer of the PV array must remedy the ground fault in the affected string. You can determine the location of the ground fault as described below. • Do **not** reconnect the faulty string. • Close the inverter and commission it as described in section 7.3 "Closing the Inverter" (page 53).
☑ You have found **no ground fault**.	It is likely that one of the thermally monitored varistors is defective. • Check the varistors as described in section 9.3.2 "Checking the Function of the Varistors" (page 68).

Location of the Ground Fault

The approximate position of the ground fault can be determined from the ratio of the measured voltages between the positive pole against ground potential (PE) and the negative pole against ground potential (PE).

Example:



In this case, the ground fault is between the 2nd and 3rd PV modules.

☑ The ground fault check is now complete.

9.3.2 Checking the Function of the Varistors

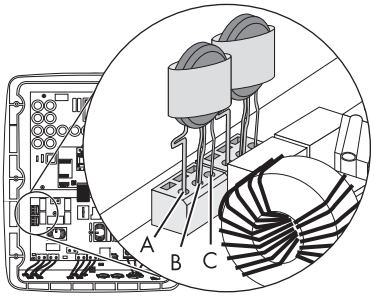
Varistors are wearing parts. Their functional efficiency diminishes with age or following repeated responses as a result of overvoltages. It is therefore possible that one of the thermally monitored varistors has lost its protective function, and thus the red LED is lit.

Position of varistors

You can determine the position of the varistors using the illustration below.

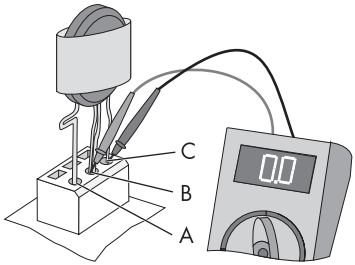
Observe the following assignment of the terminals:

- Terminal A: outer terminal (varistor connection **with loop** [crimp])
- Terminal B: middle terminal
- Terminal C: outer terminal (varistor connection **without loop** [crimp])



Check the function of the varistors as described below:

1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 50).
2. With the aid of a multimeter, determine for both varistors in the installed state whether a conductive connection exists between connectors B and C.



Result	Measure
☑ There is a **conductive** connection.	There is probably a different error in the inverter. • Contact the SMA Service Line (see section 13 "Contact" (page 81)).

Result	Measure
☑ There is **no conductive** connection.	The respective varistor is defective and must be replaced. Varistor failure is generally due to influences that affect all varistors similarly (temperature, age, induced overvoltage). SMA Solar Technology AG recommends that you replace both varistors. The varistors are specially manufactured for use in the inverter and are not commercially available. They must be ordered directly from SMA Solar Technology AG (see section 12 "Accessories" (page 80)). • To replace the varistors, proceed to step 3.

NOTICE!

Destruction of the inverter due to overvoltage.

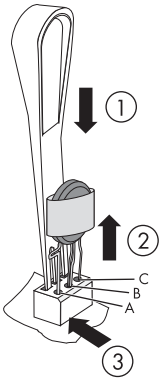
If varistors are missing, the inverter is no longer protected against overvoltages.

- Replacement varistors should be obtained as soon as possible.
- Do **not** operate the inverter without varistors in PV plants with a high risk of overvoltages.

3. Insert an insertion tool into the openings of the terminal contacts (1).

   ☑ This releases the terminals.

   If you do not receive an insertion tool for operating the terminals with your replacement varistors, contact SMA Solar Technology AG. As an alternative, the individual terminal contacts can be operated using a 3.5 mm wide screwdriver.



4. Remove the varistor (2).
5. Insert the new varistor (3).

   The pole with the small loop (crimp) must be fitted to terminal A when replacing the varistor.

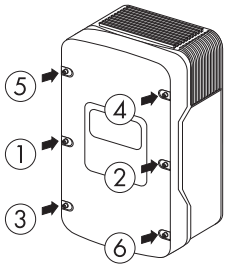
6. Close the inverter as described in section 7.3 "Closing the Inverter" (page 53).

☑ The check and replacement of the varistors is completed.

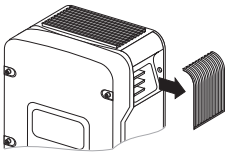
10 Decommissioning

10.1 Disassembling the Inverter

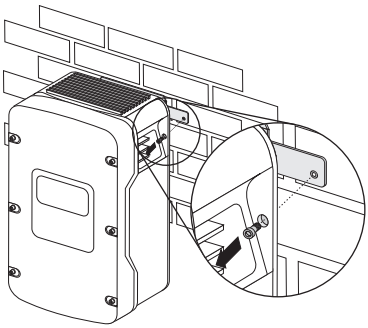
1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 50).
2. Remove all cables from the inverter.
3. Close the inverter with the 6 screws and the corresponding conical spring washers.



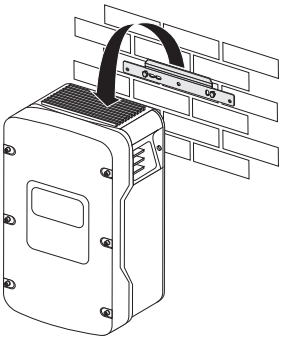
4. Remove the fan guards from both sides.



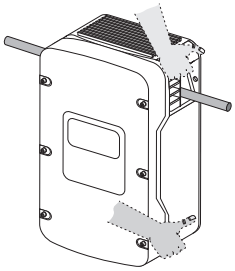
5. Remove the 2 screws on the left and right side of the inverter that attach it to the wall bracket.
6. Disconnect the anti-theft protection, if applicable.



7. Remove the inverter upwards from the wall mounting bracket.



8. Use the side handles (above and below) or a steel rod (maximum diameter 30 mm) to transport the inverter. The rod must be pushed through the enclosure openings.



☑ The inverter is disassembled.

10.2 Packing the Inverter

If possible, always pack the inverter in its original packaging. If it is no longer available, you can also use an equivalent carton. The carton must be completely closeable, have a handle system and be made to support both the weight and size of the inverter.

10.3 Storing the Inverter

Store the inverter in a dry place where ambient temperatures are always between –25°C and +60°C.

10.4 Disposing of the Inverter

Dispose of the inverter at the end of its service life in accordance with the current locally applicable disposal regulations for electronic waste. Alternatively, send it back to SMA Solar Technology AG with shipping paid by sender, and labeled "ZUR ENTSORGUNG" ("for disposal") (contact see Page 81).

11 Technical Data

11.1 DC/AC

11.1.1 Sunny Mini Central 4600A

DC Input

Maximum DC power at cos φ = 1	5 250 W
Maximum input voltage*	600 V
MPP voltage range	246 V ... 480 V
Rated input voltage	246 V
Minimum input voltage	211 V
Start input voltage	300 V
Maximum input current	26 A
Maximum input current per string	26 A
Number of independent MPP inputs	1
Strings per MPP input	4

* The maximum open-circuit voltage that can occur with –10°C cell temperature may not exceed the maximum input voltage.

AC Output

Rated power at 230 V, 50 Hz	4 600 W
Maximum apparent AC power*	5 000 VA
Rated grid voltage	230 V
Nominal AC voltage	220 V/230 V/240 V
AC voltage range	160 V ... 265 V
Nominal AC current at 220 V	20.9 A
Nominal AC current at 230 V	20.0 A
Nominal AC current at 240 V	19.16 A
Maximum output current	26 A
Total harmonic factor of the output current with AC voltage < 2% and AC power > 50% of rated power	≤ 3%
Rated power frequency	50 Hz
AC power frequency	50 Hz/60 Hz
Operating range at AC power frequency 50 Hz	44 Hz ... 55 Hz
Operating range at AC power frequency 60 Hz	54 Hz ... 65 Hz
Displacement power factor, adjustable**	$0.8_{overexcited}$ ... $0.8_{underexcited}$
Power factor at nominal AC power***	1
Feed-in phases	1
Connection phases	1
Overvoltage category according to IEC 60664-1	III

* 4 600 VA with VDE-AR-N 4105

** Applies to SMC 4600A-11

*** Applies to SMC 4600A

Efficiency

Maximum efficiency, η_{max}	96.1%
European weighted efficiency, η_{EU}	95.3%

11.1.2 Sunny Mini Central 5000A

DC Input

Maximum DC power at cos φ = 1	5 750 W
Maximum input voltage*	600 V
MPP voltage range	246 V ... 480 V
Rated input voltage	246 V
Minimum input voltage	211 V
Start input voltage	300 V
Maximum input current	26 A
Maximum input current per string	26 A
Number of independent MPP inputs	1
Strings per MPP input	4

* The maximum open-circuit voltage that can occur with –10°C cell temperature may not exceed the maximum input voltage.

AC Output

Rated power at 230 V, 50 Hz	5 000 W
Maximum apparent AC power	5 500 VA
Rated grid voltage	230 V
Nominal AC voltage	220 V/230 V/240 V
AC voltage range	160 V ... 265 V
Nominal AC current at 220 V	22.7 A
Nominal AC current at 230 V	21.7 A
Nominal AC current at 240 V	20.8 A
Maximum output current	26 A
Total harmonic factor of the output current with AC voltage < 2% and AC power > 50% of rated power	≤ 3%
Rated power frequency	50 Hz
AC power frequency	50 Hz/60 Hz
Operating range at AC power frequency 50 Hz	44 Hz ... 55 Hz
Operating range at AC power frequency 60 Hz	54 Hz ... 65 Hz
Displacement power factor, adjustable*	$0.8_{overexcited}$ ... $0.8_{underexcited}$
Power factor at nominal AC power**	1
Feed-in phases	1
Connection phases	1
Overvoltage category according to IEC 60664-1	III

* Applies to SMC 5000A-11

** Applies to SMC 5000A

Efficiency

Maximum efficiency, η_{max}	96.1%
European weighted efficiency, η_{EU}	95.3%

11.1.3 Sunny Mini Central 6000A

DC Input

Maximum DC power at cos φ = 1	6 300 W
Maximum input voltage*	600 V
MPP voltage range	246 V ... 480 V
Rated input voltage	246 V
Minimum input voltage	211 V
Start input voltage	300 V
Maximum input current	26 A
Maximum input current per string	26 A
Number of independent MPP inputs	1
Strings per MPP input	4

* The maximum open-circuit voltage that can occur with –10°C cell temperature may not exceed the maximum input voltage.

AC Output

Rated power at 230 V, 50 Hz	6 000 W
Maximum apparent AC power	6 000 VA
Rated grid voltage	230 V
Nominal AC voltage	220 V/230 V/240 V
AC voltage range	160 V ... 265 V
Nominal AC current at 230 V	26 A
Nominal AC current at 240 V	25 A
Maximum output current	26 A
Total harmonic factor of the output current with AC voltage < 2% and AC power > 50% of rated power	≤ 3%
Rated power frequency	50 Hz
AC power frequency	50 Hz/60 Hz
Operating range at AC power frequency 50 Hz	44 Hz ... 55 Hz
Operating range at AC power frequency 60 Hz	54 Hz ... 65 Hz
Displacement power factor, adjustable*	$0.8_{overexcited}$ ... $0.8_{underexcited}$
Power factor at nominal AC power**	1
Feed-in phases	1
Connection phases	1
Overvoltage category according to IEC 60664-1	III

* Applies to SMC 6000A-11

** Applies to SMC 6000A

Efficiency

Maximum efficiency, η_{max}	96.1%
European weighted efficiency, η_{EU}	95.3%

11.2 General Data

Width x height x depth with Electronic Solar Switch	468 mm x 613 mm x 242 mm
Weight	63 kg
Length x width x height of packaging	396 mm x 803 mm x 596 mm
Transport weight	68 kg
Climatic category according to IEC 60721-2-1	4K4H
Operating temperature range	–25°C ... +60°C
Maximum permissible value for relative humidity, non-condensing	100%
Maximum operating altitude above MSL	2 000 m
Noise emission (typical)	≤ 42 dB(A)
Power loss in night operation	0.25 W
Topology	LF transformer
Cooling concept	OptiCool
Fan connection	designed for safe disconnection in accordance with DIN EN 50178:1998-04
Electronics degree of protection according to IEC 60529	IP65
Protection class according to IEC 62103	I

11.3 Protective Devices

DC reverse polarity protection	short-circuit diode
Input-side disconnection device	Electronic Solar Switch
DC overvoltage protection	thermally monitored varistors
AC short-circuit current capability	current control
Grid monitoring	SMA Grid Guard 2.1
Maximum permissible fuse protection	40 A
Ground fault monitoring	Insulation monitoring: $R_{iso} > 1$ MΩ
Galvanic isolation	available

11.4 Approvals

National standard as at 07/2012	SMC 4600A-11	SMC 5000A-11	SMC 6000A-11	SMC 4600A	SMC 5000A	SMC 6000A
VDE0126-1-1	✓	✓	✓	✓	✓	✓
VDE-AR-N-4105	✓	✓	✓	–	–	–
AS 4777	○	○	○	–	✓	✓
C10/11	✓	✓	✓	–	–	–
PPDS	✓	✓	✓	✓	✓	✓
GBT19939-2005	✓	✓	✓	✓	✓	✓
VDE0126-1-1/ UTE C15-712-1	✓	✓	✓	✓	✓	✓
UTE C15-712-1/ EDF SEI req.	✓	✓	✓	✓	✓	✓
PPC	✓	✓	✓	✓	✓	✓
SI 4777	○	○	○	✓	✓	✓
CEI 0-21	–	–	✓	–	–	–
EN 50438*	✓	✓	✓	✓	✓	✓
RD 1699	✓	✓	✓	–	–	–
RD 661/2007	✓	✓	✓	✓	✓	✓
IEC 61727 PEA	–	–	–	–	✓	✓
G83/1-1	–	–	–	✓	✓	✓
G59/2	✓	✓	✓	–	–	–

* EN 50438: Does not apply to all national standard deviations.

○ In planning

11.5 Climatic Conditions

According to IEC 60721-3-4, Installation Type C, Class 4K4H

Extended temperature range	–25°C ... +60°C
Extended air humidity range	0% ... 100%
Extended air pressure range	79.5 kPa ... 106 kPa

According to IEC 60721-3-4, Transport Type E, Class 2K3

Temperature range	–25°C ... +70°C

11.6 Features

DC connection	SUNCLIX DC connector
AC connection	screw terminal
Display	LC text display
Bluetooth® Wireless Technology	optional
RS485, galvanically isolated	optional

11.7 Electronic Solar Switch (ESS)

Electrical endurance in the event of a short circuit, with a nominal current of 35 A	min. 50 switching processes
Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	12 kW
Degree of protection when plugged	IP65
Degree of protection when unplugged	IP21

11.8 Torque

Enclosure lid screws	6.0 Nm
Additional ground terminal	6.0 Nm
Cheese-head screw for attaching the enclosure to the wall mounting bracket	6.0 Nm
SUNCLIX lock nut	2.0 Nm
Screw terminal AC connection	2.5 Nm
RS485 communication connection	1.5 Nm

11.9 Distribution Systems

IT system	suitable
TN-C system	suitable
TN-S system	suitable
TN-C-S system	suitable
TT system	suitable
Split Phase	suitable

12 Accessories

You will find the corresponding accessories and spare parts for your product in the following overview. If required, you can order these from SMA Solar Technology AG or your specialty retailer.

Designation	Brief description	SMA order number
Bluetooth retrofit kit	*Bluetooth* communication interface	BTPBINV-NR
Insertion tool for the replacement of varistors	insertion tool for varistors	SB-TVWZ
Electronic Solar Switch	ESS handle spare part	ESS-HANDLE:04 Also enter the inverter's serial number.
Negative grounding set	retrofit kit for the negative connection to ground of the DC input	ESHV-N-NR
Positive grounding set	retrofit kit for the positive connection to ground of the DC input	ESHV-P-NR
Replacement varistors	set of thermally monitored varistors (2) incl. insertion tool	SB-TV4
Radio retrofit kit	radio Piggy-Back for retrofitting an inverter for communication with Sunny Beam, including antenna, coaxial cable, and PG cable gland (metal)	BEAMPB-NR
Fan guard	fan guard set "right and left" as spare part	45-7202
Power Balancer plug	retrofit kit for retrofitting a Sunny Mini Central equipped with an SMA Power Balancer to the SMA Power Balancer plug-in system	PBL-SMC-10-NR
RS485 retrofit kit	RS485 interface	485PB-SMC-NR
SMA Power Balancer Y cable	connecting cable (2 x 2 m) for SMA Power Balancer plug-in system	PBL-YCABLE-10
SUNCLIX DC connector	field plug for conductor cross-sectional areas 2.5 mm² ... 6 mm²	SUNCLIX-FC6-SET

13 Contact

If you have technical problems concerning our products, contact the SMA Service Line. We need the following data in order to provide you with the necessary assistance:

- Inverter type
- Inverter serial number
- Type and number of the PV modules connected
- Optional equipment, e.g. communication products
- Blink code or display message of the inverter

SMA Solar Technology AG

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SMA Service Line

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